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**OMC Comments on the "Proposed Plan for Clean  
Up of the 'Outboard Marine Corporation/Waukegan  
Coke Plant Superfund Site'" and Feasibility Study**

**ATTACHMENT A**

**COMMENTS ON WAUKEGAN  
MANUFACTURED GAS  
AND COKE PLANT SITE  
FEASIBILITY STUDY AND PROPOSED PLAN**

**APRIL 23, 1999**

## COMMENTS ON WAUKEGAN MANUFACTURED GAS AND COKE PLANT SITE FEASIBILITY STUDY AND PROPOSED PLAN

Prepared by Outboard Marine Corporation

April 23, 1999

Outboard Marine Corporation (OMC) is submitting the following technical comments on the Waukegan Manufactured Gas and Coke Plant Feasibility Study and Proposed Plan. Although we are submitting comments on these documents at this time, we must point out that we believe that there are serious technical issues, which need to be resolved prior to finalizing the Feasibility Study and Proposed Plan for the site. Where sufficient information is available, we have proposed possible solutions to some of the technical issues which we believe will lead to significant improvements to the proposed remedy for the site, particularly in the area of redevelopment flexibility, and help reduce remedial costs. The most significant technical deficiencies are summarized below:

- The USEPA has not obtained sufficient information on the historic operations at the site, which is needed to ensure that the remedy is appropriate. In particular, we believe it is especially important that additional historical operations information be obtained for each of the four distinct periods of site operations – pre-coke plant operations, coke plant operations prior to thionizer building removal, coke plant operations after thionizer building removal, and post-coke plant activities.
- Although the Proposed Plan purports to facilitate the future redevelopment of the site, neither the Feasibility Study nor Proposed Plan identify or provide possible solutions to obvious soil and water quality concerns. This is a highly critical area which should be thoroughly analyzed in the Feasibility Study and become a major factor in development of the proposed remedy. Redevelopment issues which need to be addressed include possible high-density residential use, future constructability, infrastructure maintenance and construction, and storm water management.
- The soil cap proposed for the site does not appear to be appropriate. The Feasibility Study and Proposed Plan state that the purpose for capping the site following completion of the active soil remediation is to minimize infiltration and prevent exposure to marginal zone soils. While we agree that there appears to be some merit in preventing exposure to marginal zone soils, it is not clear to OMC that infiltration should be minimized, or that the proposed cap will significantly minimize infiltration. We also did not find adequate technical support that would justify the effectiveness of the proposed phytoremediation cap in eliminating direct human exposure.
- The soil remediation areas do not appear to be properly defined. The areas for active soil remediation do not appear to correlate to the analytical data, and the remediation areas do not take into account data previously provided by OMC to the USEPA. In addition, the creosote-impacted soils are not adequately addressed.

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

- The groundwater impacts are not adequately defined, particularly to the south of the site, and preferential flow pathways need to be investigated. In addition, we believe that in-situ groundwater remediation technologies were inappropriately excluded from consideration in the Feasibility Study and that in-situ remediation technologies can be effectively utilized at the site. Specifically, in-situ bioremediation could well be used in conjunction with biosparging to stimulate in-situ aerobic bioremediation of organic compounds. These technologies would be much less costly than the proposed groundwater remedial approach and would help to maximize the future redevelopment and use of the site.

These issues are expanded on in the following sections, and additional technical issues are also raised which we believe warrant technical review and consideration by the USEPA.

### **Understanding of Historical Operations**

As indicated in previous comments provided by OMC to the United States Environmental Protection Agency (USEPA) on September 18, 1995, sufficient investigations have not been conducted regarding the nature of the historic activities (i.e., structures, practices, etc.) or the actual source or sources of the arsenic and polynuclear aromatic hydrocarbon (PAH) impacts. This lack of data creates doubt as to whether the proposed remedy is sufficient in scope or will be able to meet the remedial objectives. The USEPA should conduct additional investigations to more fully characterize historic manufacturing activities and source areas.

Based on our review of the limited site historical data provided in the Remedial Investigation (RI) and Feasibility Study (FS), along with aerial photos available to OMC, we believe that one historic event in particular, the demolition of the thionizer building, needs to be used as a reference point in assessing historical releases. The Thylox process (a sulfur removal operation that operated in the thionizer building shown on Figure 2.1-2 in the RI) was used during the period that the coke oven gas was provided to the local gas distribution system. The sulfur removal activities were reportedly discontinued after the introduction of natural gas in 1947 and the Thylox equipment was dismantled. A 1955 aerial photograph shows that the thionizer building is dismantled at that time. The Thylox process used arsenic trioxide as a scrubbing agent in a concentrated solution, which is most likely the primary source of the arsenic impacts within the site groundwater. As a result, we believe that the existing plume of arsenic, likely in the trivalent form, was created by operations that existed between startup of the coke plant and 1947. Based on this information, the USEPA needs to obtain historical information for coke plant operations prior to thionizer building removal and coke plant operations after thionizer building removal. In conjunction with this research, information should also be obtained on the two other distinct operational periods at the site – pre-coke plant operations and post-coke plant activities.

Additional areas where we believe better historic information needs to be obtained include: (1) ammonia and phenol discharge concentrations – these “past aqueous

## OMC Comments on Waukegan Manufactured Gas and Coke Plant Site Feasibility Study and Proposed Plan (cont.)

discharges” are identified as the primary source of the deep groundwater contamination plume – no opinions can be offered as to the extent of dilution that has occurred to date and could be expected in the future without this information; (2) ammonia and phenol discharge areas- information on the potential source areas for the ammonia and phenol historic “past aqueous discharges” also needs to be obtained – there is some indication in the Administrative Record (e.g., the Treatability Study) which indicates that the ponds are the source of the plume, but the plume location does not correlate with the pond locations; and (3) contaminant identification – information correlating site contaminants to site operations needs to be obtained; contaminant information should be obtained for each of the four distinct periods of site operations – pre-coke plant operations, coke plant operations prior to thionizer building removal, coke plant operations after thionizer building removal, and post-coke plant activities.

### **Redevelopment Issues**

Redevelopment and potential future land use issues are not adequately addressed in the FS or Proposed Plan. This is a highly critical area which should be thoroughly analyzed in the FS and become a major factor in development of the proposed remedy. Redevelopment of this property is not only important to OMC, but it is also an integral part of the overall Waukegan Downtown Revitalization Program. We believe that the FS needs to analyze how future development activities would occur, and the Proposed Plan needs to be modified to ensure that sufficient flexibility for future development (either industrial/commercial or high density residential) is provided.

The most significant redevelopment issues which need to be addressed are summarized below.

#### Residential Land Use

The FS and Proposed Plan assume that the future site use will be exclusively industrial/commercial and provide no analyses of the cost or implications associated with high-density residential development. Many lakefront redevelopment projects include a high-density residential component. Therefore, we feel strongly that such an analysis is warranted and needs to be included in the FS and Proposed Plan. As part of the additional analysis, the FS and Proposed Plan need to evaluate any technical issues that would be posed by a future residential use scenario or how the solution for the marginal zone soils is either effective or ineffective for a residential scenario. We should note that OMC has recently announced its intentions to close the manufacturing facility in Waukegan, which significantly increases the potential for a residential component to be included in the redevelopment plan, particularly as part of a planned development unit.

#### Future Constructability

The FS does not adequately discuss or analyze the impact of the proposed remedy on future construction activities at the site. For example, the recommended approach in Alternative 3A for managing the arsenic-impacted soils, which will involve on-site

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

stabilization/solidification of the arsenic-impacted soils, will significantly limit the future use and/or redevelopment potential for that portion of the property (e.g., utility lines could not be routed through the area, building footings could not be constructed in the area, etc.). Consequently, we strongly recommend that the arsenic-impacted soils be managed as proposed under Alternative 3B, which involves excavation and off-site disposal. This approach would permit greater future redevelopment flexibility and is reported to be less costly than the on-site stabilization/solidification option. We should note that we do concur with the recommended approach in Alternative 3 for managing the PAH-impacted soils via excavation and off-site treatment, since this would provide greater redevelopment flexibility.

Another related issue is the management of impacted soils removed during construction activities (e.g., placement of building footings, etc.). The remedy should provide a mechanism for managing these soils on-site, which would provide maximum flexibility for future development and reduce development costs by eliminating the need for off-site disposal. One possibility for managing soils excavated in the future would be the establishment of a stockpile area that could be capped and managed as an on-site isolation cell.

#### Infrastructure Maintenance and Construction

The proposed remedy fails to address the handling or disposition of groundwater and soils that will be generated as a result of maintaining existing utilities or the construction of new utilities and structures, both public and private, either on or near the site. There are a significant number of existing utilities at or near the site; these include a 10-12 foot deep, 24" diameter storm drain that serves the OMC Information Technology building area; a 12 foot deep, 12" diameter water intake line; two 4-6 foot deep force mains, one owned by the City of Waukegan and one owned by OMC; and various other gas, electric, and communications lines owned by either Larsen Marine, the City of Waukegan, OMC, or public utilities. Given the depths of these utilities, and the shallow groundwater table at the site, OMC has found that a significant amount of de-watering is required during maintenance, repair, or construction activities, which results in handling a considerable amount of groundwater. For example, in 1992, North Shore Gas generated a peak rate of over 700 gallons per minute (gpm), and over one million gallons total, of groundwater while making a new connection to a high-pressure gas main located on the north side of the OMC Plant 2 facility. In 1996, OMC incurred substantial additional costs (more than \$50,000) for the special handling of site-related groundwater that was generated during the construction of a 3,000 sq. ft. engine testing building addition that is located on the north side of OMC's Plant 1 facility.

Provision should be made in the proposed remedy for the handling of shallow groundwater generated by de-watering activities (both for existing and new utilities). One possibility is that these waters be reinfiltrated into the aquifer in a designated location. The reinfiltration gallery could be in the form of a shallow leach field that could be installed prior to the cap. This would avoid unnecessary off-site disposal of slightly contaminated groundwater generated during utility maintenance or construction

## OMC Comments on Waukegan Manufactured Gas and Coke Plant Site Feasibility Study and Proposed Plan (cont.)

activities. The location of the infiltration gallery should be identified in the FS and selected to ensure that natural plume migration is not affected. Alternatively, barriers could be constructed that would sufficiently isolate designated “clean” groundwater zones from “impacted” zones.

Any future development activity at the site will require the installation of subsurface utilities that could result in the excavation of impacted soils. As a result, the remedy should provide for either the future special handling of potentially impacted soils and/or the construction of utility corridors where impacted soils would be removed during the soil remediation activities and replaced with clean fill to enable future construction to occur in “clean soils.” The soils removed from these corridors during remediation could be managed with the other impacted material excavated at the site.

### Storm Water Management

Another issue associated with future development is the management of storm water. We do not believe that the FS adequately discusses or analyzes this issue, and we believe this issue needs to be addressed in the proposed remedy. As the site is developed and the soil cap is replaced with buildings and parking lots, a storm water detention basin will be necessary. Consequently, the FS should consider the location of this detention basin and whether it would be designed to allow infiltration or strictly detention. In addition, the remedy should include construction of a detention pond.

### **Infiltration/Recharge**

The FS and Proposed Plan state that one purpose for capping the site following completion of the active soil remediation is to minimize infiltration (the second purpose, preventing exposure to marginal zone soils, is discussed in the next section). The FS states that the cap will help to reduce the flux of contaminants of concern (COCs) from groundwater to surface water as part of the remedy. The use of a cap is intended to reduce the amount of recharge entering the aquifer system and therefore reduce the amount of groundwater available to discharge to the surface water.

Based on our review of the available data, it is not clear that infiltration needs to be minimized, or that the proposed site cap will significantly reduce the water flux through the site. In addition, the groundwater modeling does not demonstrate that a cap will significantly reduce the flux of COCs to the surface water bodies. Our concerns with use of the cap for minimizing infiltration, as well as the infiltration analysis presented in the FS, are summarized below.

- Currently, direct infiltration on the site supplies oxygenated groundwater to the shallow and deeper portions of the aquifer, which appears to be degrading the COCs via bioremediation and other natural attenuation mechanisms, particularly in the shallow portion of the aquifer. By installing a cap on the site, infiltration of oxygenated groundwater will be reduced, which will in turn reduce the amount of

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

degradation of the COCs. This may lead to an increased flux of COCs to surface water bodies since natural attenuation mechanisms will not be as prevalent.

- The proposed cap (asphalt, phyto, or a combination) has been designated for only a portion of the site. Based on the groundwater flow modeling report in Appendix 2-B of the FS, the infiltration rates associated with the beach area portion of the site range from 2.6 to 3.4 times higher than those on the portion of the site that is proposed to be capped. Using modeling scenarios in the FS, the area of higher infiltration corresponds to the area of highest concentration of COCs in the deep portion of the aquifer (FS Figures 2-18, 2-20, 2-22, 4-2, 4-3, and 4-4). Since no cap is proposed for the beach area, infiltration to the groundwater will continue, and the resulting flux of COCs to surface water bodies will also continue.
- A comparison between the no action groundwater flow model (FS Figure 5-D-9) and the “0%” infiltration model (FS Figure 5-D-14) indicates that the north-south trending groundwater ridge shifts to the east over the beach area with the addition of a cap. This shift will result in a change in groundwater flow direction to the west in the area of elevated concentrations of COCs under the beach. The change in groundwater flow direction will lead to higher mass flux of COCs towards the Harbor, which is contrary to the goal of the cap.
- The modeling indicates that groundwater elevations in the beach area would drop by approximately 0.25 feet with the placement of the cap over the selected area; however, the horizontal gradients towards the lake (under the beach area) and the Harbor show little change. As an example, horizontal gradients calculated using Figures 5-D-9 and 5-D-14 from the FS indicate a horizontal gradient of 0.0038 under the beach with no cap and a horizontal gradient of 0.0033 for a “0%” infiltration cap. Using these same figures, the horizontal gradient calculated under the Coke Plant site was 0.0013 with no cap, and 0.0009 with a “0%” infiltration cap. We believe that these small changes in the horizontal gradients do not imply significant changes in COC flux to surface water bodies.
- Several assumptions were made as part of the conceptual model for the SLAEM calculations that may lead to inaccurate conclusions. The conceptual model assumes that the east end of the OMC Waukegan Plant 2 acts as a hydraulic barrier due to subsurface structures, which consist of tunnels and footings. The tunnel inverts are approximately 7 feet below ground surface; therefore the tunnels only penetrate the aquifer approximately 4 feet. Since the base of the aquifer is approximately 28 to 30 feet below the ground surface, these would not act as a barrier to groundwater flow. The footings are set to approximately 14.5 feet below ground surface. The majority of the footing dimensions are 7 feet by 7 feet and are spaced at least 20 feet apart in the east/west direction and, consequently, would only act to partially restrict groundwater flow. Consequently, we believe the assumption that the east end of the OMC Waukegan Plant 2 would act as a barrier to groundwater flow would likely cause an under estimation of groundwater recharge from the north.

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

- The conceptual model for the site also does not appear to account for groundwater recharge to the peninsula that would come from the west under the OMC Waukegan Plant 2 site. By not accounting for recharge from the west, the loss of recharge to the site from infiltration may not have been properly off set by increased recharge from the north.
- In Section 3.3.4.2 of the FS, reducing infiltration to the peninsula is discussed, and there is a statement that the analysis in Appendix 2-D of the FS shows that “maintaining the mass flux to the harbor and breakwater areas is protective of the surface water quality. Reducing the mass flux by slowing groundwater discharge to these areas would provide an additional factor of safety for these waters.” Since the mass flux to the harbor and breakwater areas (i.e., infiltration) is protective of the surface water quality, one must question the need to reduce infiltration at the site after completion of the soil and groundwater remediation efforts. Although reducing infiltration has the potential to provide a small safety factor for the surface waters, the remediation of the “hot spot” soil areas and high concentration groundwater areas will provide the most significant safety factor for protecting the surface waters.

OMC recommends that the need to reduce infiltration at the site after completion of the active remediation efforts be reevaluated in the FS and Proposed Plan. As part of this reevaluation, the modeling presented in the FS should be redone to account for the information presented above. In addition, the reevaluation should specifically address the actual effect that the cap will have on reducing infiltration to the deep groundwater impacts and the effect that reducing infiltration will have on the flux of COCs to the lake and harbor.

### **Soil Cap**

OMC questions the appropriateness the phytoremediation cap proposed for the site. The stated objective of the phytoremediation cap is “to minimize infiltration, reduce flux to the harbor, and eliminate future direct exposure”. There is also a discussion that the phytoremediation cap will help to remediate residual impacts in the soil. As discussed above, we do not believe that minimizing infiltration to reduce flux to the harbor is justified. More importantly, no justification is provided that supports the use of the 6-inch thick phytoremediation cap for controlling direct contact human health exposures. There will likely be significant periods of time when vegetation is not present on the cover (e.g., winter months, dry conditions, etc.). During these conditions, or in areas with only sparse growth, the six inches of cover material may not provide sufficient protection against direct exposure. We also do not believe that the phytoremediation cap is likely to provide remediation benefits since the residual impacts do not appear to exceed direct exposure risk levels, and therefore do not require remediation. In addition, the FS acknowledges that the phytoremediation will take years to become effective; by the time it becomes effective, the site will likely be redeveloped. Finally, we also believe that significant costs will be incurred in maintaining the phytoremediation cover (Appendix 4-F of the FS provides an order of magnitude cost of \$85,000 per year for maintaining the phytoremediation cap).

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

We believe that the cap for the site should primarily focus on preventing exposure to soils with contaminant concentrations exceeding direct contact risk-based standards; we do not believe that this was clearly addressed in the FS or Proposed Plan. We recommend that an adequate soil cover be used for this purpose. This capping method would be highly effective at preventing direct exposure, is much less maintenance intensive than a phytoremediation or asphalt cap, and would help to maximize the property's redevelopment potential. This method was not retained for alternative evaluation since it "does not reduce infiltration". We disagree with this rationale for not retaining this capping method. A soil cover cap would help to reduce infiltration (the discussion of the use of a soil cover in Appendix 4-C of the FS supports this argument); furthermore, as discussed above, we do not believe that minimizing infiltration is a critical function for the cap. We should note that the 6-inch thick cap proposed for the site is not consistent with the requirements for capping identified in the Illinois Tiered Approach to Corrective Action Objectives (TACO) regulations, which require that a minimum of 3 feet of clean soil be used.

We also take issue with the extent of the cap proposed for Alternative 3. Section 5.3.2.1 of the FS states that the cap for the soil remedy for Alternative 3A is "sized to cover not only the Remediation and Marginal Zones, but also other parts of the site". As previously stated, a site-wide cap is not necessary and would place an unnecessary restriction on the future use or redevelopment potential for the property. From a risk standpoint, the FS indicates that capping the marginal zone soils will be sufficiently protective of human health; capping the entire site is never suggested. Consequently, we recommend that the cap associated with Alternative 3 be revised to only cover the Remediation and Marginal Zone soils.

### **Soil Remediation Areas**

1. Although the Proposed Plan briefly discusses the creosote-impacted soils at the site, these soils do not appear to be addressed in the Feasibility Study. The FS needs to be revised to address these soils, and the discussion of these soils in the Proposed Plan needs to be expanded.
2. The arsenic remediation area overlaps with the area of highest PAH contamination at the site. This condition may affect disposal options by preventing thermal treatment of a portion of the PAH remediation zone. The implication of this issue with respect to both implementation and remediation costs needs to be addressed in the FS. In addition, we note that the waste characterization of the arsenic remediation zone soils appears to be insufficient since the TCLP samples referenced in the FS do not appear to have included any samples from the arsenic remediation zone. The waste characterization for the arsenic-impacted soils needs to be reevaluated, and FS needs to be revised to address the impact of the arsenic-impacted soils on the options and costs for PAH-impacted soil disposal.

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

3. In Section 5 of the Feasibility Study, the area of active remediation proposed for the arsenic-impacted soils is based solely on the data collected during the RI and FS; it does not take into account the data collected by OMC as part of their proposed parking lot expansion on the southern portion of the site, which was submitted to the USEPA on May 28, 1998. OMC recommends that the area for arsenic-impacted soil remediation be reevaluated based on the OMC data.
4. The arsenic remediation zone depicted on Figure 4-1 does not appear to accurately reflect the arsenic concentrations measured at the site, which are summarized on Figure 2-7. Considering the target soil concentrations developed using the representative high exposure scenario (summarized on Table 3-3), the arsenic remediation zone needs to be expanded in both the north and south directions. In addition, a small separate area for arsenic remediation needs to be identified west of the main arsenic remediation zone (around sample SB-26).
5. The PAH remediation zone depicted on Figure 4-1 does not correlate with the 100 mg/kg isopleth line depicted on Figure 2-6. The basis for the PAH remediation zone needs to be clearly defined; if one or more PAHs are "driving" the remediation zones, a figure providing those PAH concentrations across the site needs to be provided. In general, a better explanation of the PAH remediation zones needs to be presented.
6. The PAH remediation zone depicted on Figure 4-1 shows that the southern portion of the proposed remediation area will extend onto the OMC property immediately north of Plant 1. The data presented in the RI and FS reports are not sufficient to define the southern extent of this remediation area. Additional investigation will be necessary to define the area of PAH remediation. In addition, the remediation in this area will significantly disrupt OMC traffic and parking on the north side of Plant 1. OMC requests that the remediation in this area be phased such that a clear and safe traffic pattern is available at all times and appropriate measures are taken to secure work areas in order to limit access. OMC will also require that any utilities encountered in this area be properly supported and/or removed and replaced.

**Extent of Groundwater Impacts**

1. In Section 2.2.2 of the Feasibility Study, as well as in other sections, the groundwater flow pattern at the site is described as being east and southeast (towards Lake Michigan) and west and southwest (toward the harbor). However, based on the groundwater level data for the site and the associated piezometric head contours presented in Appendix 2-B of the Feasibility Study, there is clearly a southern component to the groundwater flow pattern. This southern groundwater flow has clearly resulted in contaminant movement onto the OMC Plant 1 property south of the site; in fact, very high concentrations of ammonia and benzene are present in monitoring wells MW-8 and MW-10, both of which are located near the boundary between the Waukegan Manufactured Gas and Coke Plant site and OMC property south of the site.

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

OMC makes two specific recommendations regarding this issue. (A) Additional investigative efforts should be undertaken to better understand the groundwater flow and contaminant distribution on the southern portion of the site, including assessing the southern extent of the ammonia and benzene impacts in the deep aquifer. (B) After completion of the additional investigation, the contaminant fate and transport modeling presented in the Feasibility Study should be revised to fully evaluate contaminant movement in the southern direction. We also note that groundwater impacts beneath the City of Waukegan Water Treatment Plant located south of OMC may also need to be investigated depending on the results of the additional investigation south of the site.

2. OMC also believes that additional investigations need to be conducted to address the area north of the site. During review of data obtained by OMC as part of a UST closure investigation near the southeast corner of Plant 2, two samples were identified that indicate contaminants related to the site (arsenic, benzene, etc.) are present within the deep portion of the aquifer at this location. This suggests that alternate flow patterns may have occurred, which needs to be evaluated in the FS. A copy of the relevant data from this investigation is attached.
3. OMC believes that the FS needs to provide a discussion of whether any preferential flow pathways have affected the migration of contaminants in the subsurface. Preferential pathways could be established by utility line backfill materials, as well as utility lines themselves (e.g., contaminant movement through a leaking sewer pipe). The effectiveness of the proposed groundwater remedial strategy needs to be evaluated with respect to potential preferential migration pathways. In particular, OMC has previously raised concerns to USEPA about the potential infiltration of contaminated groundwater to sewer lines, including the Information Technology building storm water drain, that drain to Waukegan Harbor. We again have found no information concerning the investigation of this potentially important pathway to the Harbor.

### **Groundwater Remediation**

OMC believes that in-situ groundwater remediation technologies were inappropriately excluded from consideration in the FS. In-situ remediation technologies were excluded since the aerobic biological treatability study previously performed at the site showed that groundwater collected from the site monitoring well with the highest concentrations (i.e., MW-7D) did not support in-situ bioremediation. However, the treatability study used groundwater that was considerably more impacted than that present in the beach area as the basis for determining that the technology was not appropriate. The treatability study showed that aerobic bioremediation does occur within the site groundwater after sufficient dilution or mixing takes place (i.e., at lower contaminant concentrations). In fact, the lower concentrations along the beach transect are evidence of either dilution or biodegradation and should have been considered in evaluating the area for groundwater treatment. Furthermore, the beach/lake interface is the point of compliance for the site

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

remedial scenarios, so that treatment in this area to acceptable levels will meet the remedial objectives of containment for Alternatives 2 and 3.

Specifically, OMC believes that two potentially viable technologies were not properly considered for remediation of the organic contaminants within the site groundwater: (a) In-Situ Bioremediation, which would involve increasing the oxygen content of the deep groundwater by the introduction of an oxygen releasing compound or air sparging to stimulate in-situ aerobic bioremediation; and (b) Biosparging, which would involve use of vertical groundwater circulation wells (GCWs) within the deep portion of the aquifer to dilute the contaminant levels, stimulate in-situ aerobic bioremediation and strip volatile organic compounds. Both of these technologies were apparently excluded because of the treatability study results, which, as discussed above, we believe were inappropriately interpreted. OMC recommends that the groundwater remediation approach for the site be reconsidered, and that the potential use of these technologies be thoroughly evaluated for use in remediating the site organic contaminants. These technologies would be much less costly than the proposed groundwater remedial approach, and would help to maximize the future use/redevelopment of the site, since only minimal above grade structures would be needed. Additionally, these technologies could be used in tandem – the GCWs could be used at the highest concentration areas to help dilute the concentrations and establish acceptable bioremediation conditions, while the oxygen enhancement technologies could be applied initially at the lower concentration areas (where concentrations do not inhibit bioremediation) and then subsequently applied at the high concentration areas after sufficient dilution has occurred.

In conjunction with the use of in-situ bioremediation/biosparging for organic contaminant remediation, in-situ treatment of arsenic could also be performed. Based on a limited literature search, we believe that the arsenic impacts can be remediated in-situ using either precipitation or sorption (see “In-situ Precipitation and Sorption of Arsenic from Groundwater”, 1997 International Containment Technology Conference, Whang, Wusu, Frampton and Staib).

We also believe that the proposed groundwater remediation plan does not adequately address the areas south of the site. The remedial action objective (RAO) for the site groundwater stated in the FS is to “control the off-site migration of contaminant in the groundwater to surrounding surface water bodies which would result in exceedances of ARARs for COCs in surrounding surface waters”. During the September 1998 surface water sampling conducted by Barr Engineering, concentrations of both benzene and ammonia were detected in surface water samples collected south of the site (H-1 and H-2). The source of the benzene and ammonia have not been identified, and these detections may indicate that the southern migration of contaminants from the site could be adversely impacting the surrounding surface water bodies. Furthermore, the potential impacts to the City Water Plant and OMC’s Plant 1 site should be evaluated to establish appropriate site-based remedial objectives.

The impact of the proposed groundwater remediation on users of the public beach, as well as OMC and Larsen Marine, is not discussed in the FS. The proposed groundwater

## OMC Comments on Waukegan Manufactured Gas and Coke Plant Site Feasibility Study and Proposed Plan (cont.)

remedy will tie up significant areas of the beach and OMC property; setback zones will most likely also be required for safety purposes, further disrupting beach users and OMC. This needs to be evaluated in the FS, and, more specifically, needs to be contrasted against less intrusive in-situ remediation methods.

OMC found no evidence that the FS properly considered or evaluated the various forms of arsenic which are likely present in the groundwater, the risks posed by arsenic to human and ecological receptors and arsenic's impact on the proposed groundwater remedy. A summary of our concerns are provided below:

- There is insufficient discussion in the FS on how the form of arsenic (i.e., pentavalent or the more toxic trivalent) affects toxicity and mobility, and impacts treatment options.
- Our review of the FS and risk assessment documents suggests inconsistency as to whether arsenic poses a risk and therefore could adversely affect receptors. For instance, arsenic is a constituent of concern for the human health risk assessment, but not the ecological risk assessment. This issue needs to be clarified.
- Arsenic is not identified as a compound that is "driving" remediation of the groundwater, but its presence in groundwater has implications for the treatment options if groundwater is extracted. The FS and aerobic groundwater treatability study do not address the form of the arsenic in the evaluation and the associated risks posed by the presence of arsenic. The different solubilities and risks associated with various forms of arsenic need to be addressed in the FS to ensure that the appropriate remedial technology is being selected.

OMC also believes that the FS is not clear as to the rationale used to define the groundwater remediation. Two compounds, phenol and ammonia, were determined to be present at levels that could discharge to Lake Michigan above the open water quality standard, and therefore were identified as "drivers" of the remediation. This conclusion does not appear to be carried through to the development of the remedial action objectives and screening of the applicable groundwater technologies; this inconsistency needs to be clarified in the FS. As an example, the use of the arsenic plume to define the limits of the active groundwater remediation is inconsistent with Section 3.3 of the FS, where the stated groundwater remedial action objectives are based on prevention of phenol and ammonia discharges to Lake Michigan at unacceptable levels.

### **Additional Comments**

OMC offers the following additional comments on the FS and Proposed Plan, as well as the risk assessment completed by CH2M Hill, which forms the basis for remedial action objectives presented in the FS.

1. Appendix 2-C of the FS presents an analysis of the effect of peninsular groundwater hydraulics on groundwater flow and chemical distribution. As part of this analysis, there is an assumption made that aqueous discharges from the site occurred from 1928 until site grading after building demolition in 1972. Given the information

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

presented in the “Understanding of Historical Operations” section above, it is clear that the arsenic discharges at the site would have ended in approximately 1947. Consequently, the analysis presented in Appendix 2-C needs to be redone to account for this shortened arsenic discharge period. OMC also questions the use of chloride as a conservative surrogate for the analysis, since the chloride source areas and discharge duration have not been identified.

2. Appendix 3-C of the FS presents the process used to calculate the target soil concentration (TSC) for arsenic for protection of groundwater. A 25-mg/kg value is calculated as the site-specific TSC. We believe that this value is too restrictive – the Tier 1 value provided in the Illinois TACO regulations, which is pH dependent, ranges from 25 to 31 mg/kg for Class I groundwater. The calculated mean pH for the available surface soil data is 7.8 +/- 1.3; this corresponds to an arsenic cleanup objective of 31 mg/kg, which would be a more appropriate TSC. This issue needs to be evaluated in the FS.
3. The remedy proposed under Alternative 3 effectively eliminates the groundwater ingestion pathway (i.e., the remedy will satisfy all of the criteria for eliminating the groundwater ingestion exposure route under the Illinois TACO regulations). Consequently, the soil cleanup objectives for protection of groundwater for arsenic or any other contaminants of concern do not need be considered when determining remedial action objectives. We believe that the use of the arsenic soil cleanup objective for the protection of groundwater as a remedial action objective needs to be reevaluated in the FS.
4. Within the Proposed Plan and FS, there are several discussions regarding the contaminants of concern within the site groundwater. The listing of contaminants vary between discussions – for example, the Executive Summary of the Feasibility Study states that the impacted groundwater has elevated concentrations of arsenic, phenols and ammonia, while the Proposed Plan states that the major contaminants of concern within the groundwater are arsenic, benzene, phenol, thiocyanate and ammonia. The documents need to be revised to ensure that they are consistent and clear as to which contaminants within the site groundwater are considered to be a concern.
5. In Section 3.2.3 of the FS, there is a statement that the soil at the site is not a RCRA hazardous material. This statement is not correct – one of the waste characterization samples collected during the RI (sample TT2401) failed the TCLP for benzene (in addition, it is more appropriate to refer to RCRA hazardous waste, not hazardous material). This portion of the text needs to be rewritten to reflect all waste characterization results, and should also discuss the USEPA guidance related to the management of MGP-related hazardous waste, which is provided as part of the current administrative record.
6. Appendix 2-D of the FS presents an analysis of the effect of groundwater mixing with surface water and the potential effects of groundwater discharges on surface water

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

quality. However, there is no discussion on how the predicted surface water concentrations compare to the measured concentrations, and if this comparison supports the mixing ratios proposed by the model. This discussion should be included in the FS. Furthermore, there needs to be additional discussions regarding how these modeled concentrations relate to the groundwater remedial action objectives.

7. In Appendix 3-A of the FS, there is a statement made that constraints are in place to prohibit placement of individual water wells, which will eliminate the groundwater ingestion pathway. Under the Illinois TACO regulations, there are specific procedures which must be followed to prohibit the use and installation of potable water wells, including the requirement for the local government to pass an ordinance that meets specific goals set out by the IEPA. The procedures provided in TACO to formally eliminate the groundwater ingestion pathway should be discussed in the FS and incorporated into the Proposed Plan.
8. In Appendix 4-F of the FS, a cost for an HDPE geomembrane is included in the cost estimate for an asphalt cap. The use of a membrane in conjunction with the asphalt cap is not discussed in detail with the FS. Given the significant cost of the membrane, the use of a membrane with the asphalt cap needs to be justified and discussed in the FS.
9. In Appendix 5-A of the FS, there is a discussion that transportation of PAH-impacted soils to the Illinois Power facility near St. Louis, MO would be less complicated if trucks were used as opposed to a barge. The cost estimates presented in the FS apparently use costs for trucking the soils to Illinois Power. Given the relatively large volume of soil and the accessibility of water and rail transportation, the cost to transport the impacted soils via barge or rail should be considered in the FS.
10. As discussed in the "1998 Waukegan Harbor and Lake Michigan Surface Water Sampling, Waukegan Manufactured Gas and Coke Plant Site" Work Plan, the field parameters of pH, conductivity, and temperature are to be recorded every 5 minutes after a stable pumping rate is established. Once three consecutive readings and 30 gallons of water have been purged, the surface water sample may be collected. Documentation of the field parameter measurements needs to be provided in the FS, and compliance with the requirements of the Surface Water Sampling Work Plan needs to be discussed.
11. A spot check of the field parameters associated with the July 7, 1996 groundwater sampling event indicated that approximately 37% of the monitoring wells had not stabilized at the time of sampling. The criteria used to verify stabilization is outlined in the July 1, 1991 "Sampling and Analysis Plan." An explanation needs to be provided in the FS as to why monitoring wells were not allowed to stabilize in all cases.

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

12. Groundwater and surface water sampling was conducted by Barr Engineering during the time period July 15 through 19, 1996 and documented in a sampling report dated August 9, 1996. A comment in the "Waukegan Sampling Notes" references a soil sample collected 200 feet east of monitoring well nest MW-13. The soil sample was obtained by excavating down to the water table and collecting six 8- oz. containers filled with water saturated soils. In addition, the note states that the samples were sent to GTI. Based on a review of the procedures in GTI's treatability study, no site soil samples were specifically identified. These soils do not represent aquifer conditions in the region of the groundwater impacts. The use of these soils and associated analyses need to be discussed in the FS.
13. The human health risk assessment was developed using a screening approach to identify constituents of potential concern (COPCs). The COPCs were selected if the individual constituent excess cancer risk exceeded  $10^{-6}$  or that the non-cancer risk contributed 1 percent of the total risk. The risk assessment then evaluated potential exposures and risks to constituents exceeding the screening levels. This approach would be acceptable except that in the FS, the target risk levels for individual constituents were set at  $10^{-6}$  or  $10^{-5}$  and the cumulative risk could exceed the target level. As a result, the screening procedure in the risk assessment should have been reviewed to ensure that all of the constituents with screening levels of  $10^{-7}$  or higher were considered in developing the soil cleanup levels. Under the Illinois TACO regulations, the acceptable risk level is  $10^{-6}$  under Tiers 1 and 2, with some flexibility for acceptable risk under Tier 3. Following the Illinois regulations, justification for the higher target risk level should be provided. This was not done in the FS. Additionally, the Illinois regulations require that the target risk level be met at the exposure point. This would imply that this would be a cumulative risk rather than the individual constituent risk. Therefore, the FS should be revised to indicate that the risks fall within an acceptable risk range that will meet all appropriate ARARs.
14. Groundwater data have been collected since the risk assessment was prepared in 1995. The data used in the risk assessment should be compared with the more recent data to ensure that conditions at the site are accurately characterized. It is possible that conditions at the site have improved over time and that the risks identified in the risk assessment overestimate actual or hypothetical risks at the site. Thus, a discussion needs to be provided in the FS that documents that the risk assessment inputs have not changed sufficiently to require recalculating site risks.
15. The FS develops target cleanup levels for three scenarios: reasonable maximum (RME), central tendency (CTE), and representative high exposure (RHE). In each case, the exposure assumptions are developed based on a combination of USEPA default assumptions and professional judgment. The RHE does not appear to be a scenario that is outlined in either USEPA guidance or Illinois regulations. The RHE case appears to be the preferred approach for developing cleanup levels in the FS. The exposure assumptions used in this scenario are a combination of conservative and realistic assumptions. Because the assumptions are different and the target risk level greater, the cleanup levels developed for the RHE tend to be higher than those

OMC Comments on Waukegan Manufactured Gas and Coke Plant Site  
Feasibility Study and Proposed Plan (cont.)

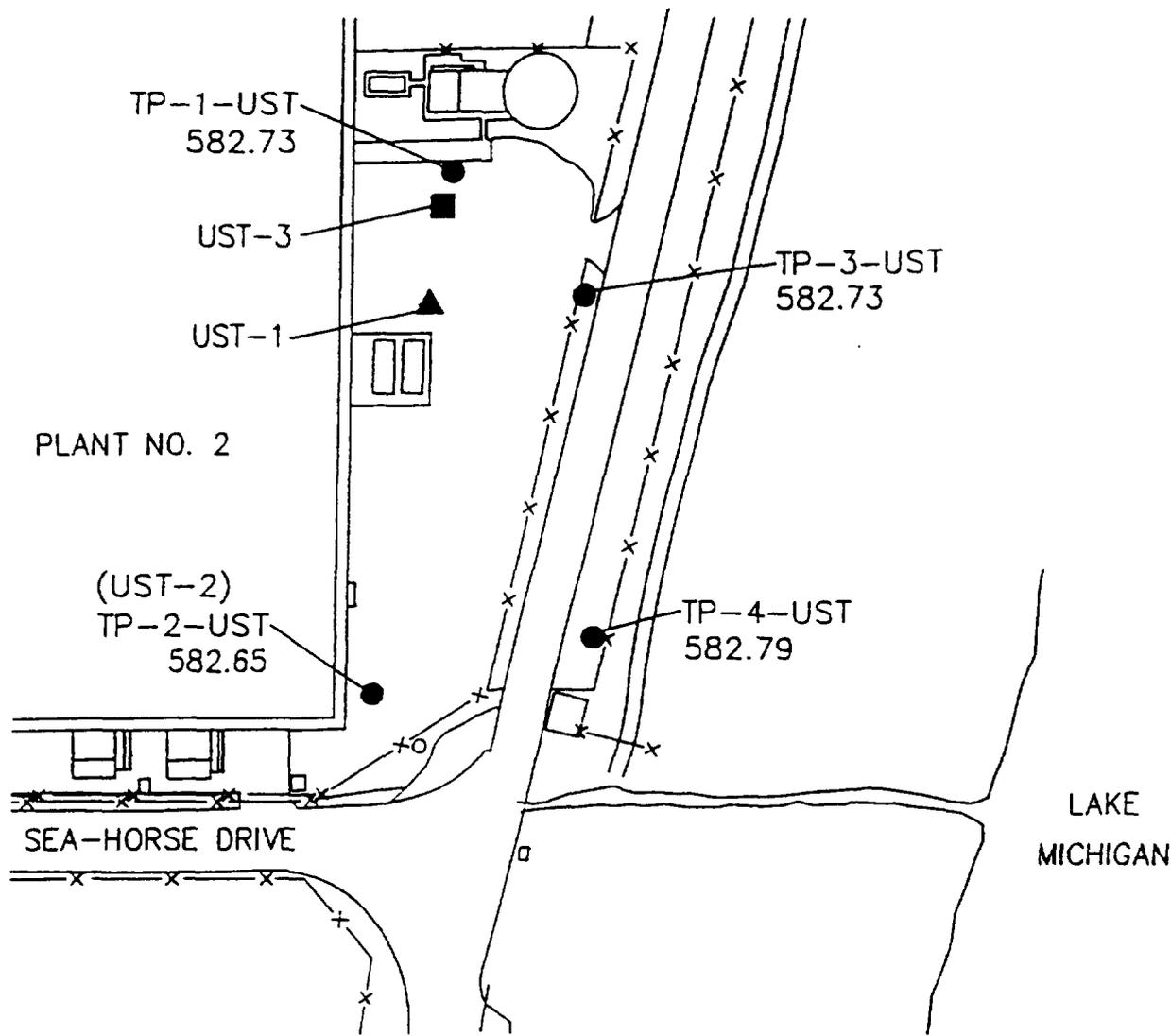
corresponding to the other scenarios. The use of the RHE may also result in cleanup levels exceeding the IEPA acceptable risk level when considering additive effects from exposure to different constituents (see above). Justification for use of the RHE and its underlying assumptions needs to be presented in the FS.

16. Arsenic toxicity to wildlife is dependent on its form. The risk assessment indicated that only 20 percent of the total arsenic at the site was likely present in the inorganic form. Without presenting information on the source of the arsenic, this conclusion may be erroneous. Some data were available indicating that arsenic was present more in the pentavalent form rather than in the more toxic trivalent form. The possible impacts of arsenic on ecological receptors should be reevaluated in the FS to more clearly account for arsenic's form in the environment.
17. The risk assessment performed for the site needs to be revised to consider a possible residential redevelopment (see discussion under "Redevelopment Issues" above).
18. Appendix 3-B of the FS discusses the development of target soil concentrations protective of human health. Throughout this discussion, there is reference to "Illinois/IEPA guidance", and a specific statement that the Illinois guidance provides a cancer target risk value of one excess cancer in one-hundred thousand over background risk level for the cancer endpoint. The specific Illinois /IEPA guidance should be referenced (if the TACO regulations are being referenced, these are regulations, not guidance), and the use of  $10^{-5}$  excess cancer risk by the State of Illinois needs to be better substantiated.
19. Appendix 4-A of the Feasibility Study provides a preliminary evaluation of the effectiveness of the proposed vadose zone soil remediation. Throughout this discussion, there is reference to  $10^{-4}$  RHE soil risk levels. However, in Appendix 3-A, a  $10^{-5}$  excess cancer risk appears to be used. This discrepancy needs to be explained.

Table d  
 Grounwater Analytical Summary  
 Die Cast USTs  
 OMC Waukegan Plant No. 2

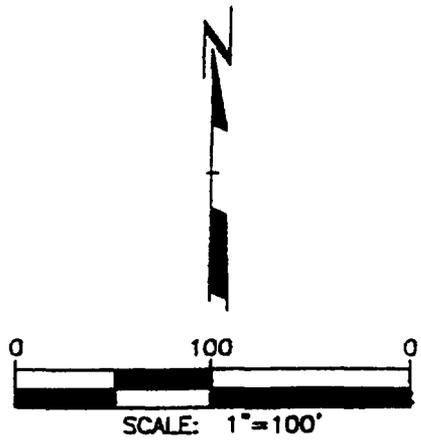
Sample Name	HYUST-1	HYUST-2	
Sample Location	UST-1	TP-2-UST (UST-2)	
Sample Depth	30 bgs	32 bgs	
Sample Date	07/10/97	07/10/97	
Parameters			
Arsenic (Method 7060)			
Arsenic (total)	0.139	1.34	(mg/L)
Arsenic (dissolved)	0.120	1.28	(mg/L)
TPH (Method 8015M)			
TPH (as Gasoline)	<0.5	<0.5	(mg/L)
TPH (as Diesel Fuel)	<0.5	<0.5	(mg/L)
TPH (as Oil)	<0.5	<0.5	(mg/L)
Detected VOCs (Method 8240B)			
Benzene	ND	0.075	(mg/L)
Chloroethane	ND	0.015	(mg/L)
1,1-Dichloroethane	ND	0.0017	(mg/L)
cis-1,2-Dichloroethene	ND	0.0062	(mg/L)
Toluene	ND	0.0021	(mg/L)
Vinyl Chloride	ND	0.013	(mg/L)
Detected PNAs (Method 8310)			
Benzo (a) anthracene (total)	ND	0.00098	(mg/L)
Benzo (a) anthracene (dissolved)	NA	ND	(mg/L)
Benzo (b) fluoranthene (total)	ND	0.00062	(mg/L)
Benzo (b) fluoranthene (dissolved)	NA	ND	(mg/L)
Benzo (a) pyrene (total)	ND	0.00079	(mg/L)
Benzo (a) pyrene (dissolved)	NA	ND	(mg/L)
Fluoranthene (total)	ND	0.0058	(mg/L)
Fluoranthene (dissolved)	NA	ND	(mg/L)
Fluorene (total)	ND	0.0022	(mg/L)
Fluorene (dissolved)	NA	ND	(mg/L)
Phenanthrene (total)	ND	0.0068	(mg/L)
Phenanthrene (dissolved)	NA	ND	(mg/L)
Pyrene (total)	ND	0.0039	(mg/L)
Pyrene (disolved)	NA	ND	(mg/L)

bgs - below ground surface  
 ND - Not Detected above the reporting limit  
 NA - Not analyzed



**LEGEND**

- x-x-x-x- FENCE
- ▲ UST-1 GROUNDWATER SAMPLE LOCATION
- UST-3 SOIL SAMPLE LOCATION
- TP-1 TEMPORARY PIEZOMETER AND GROUNDWATER ELEVATION  
582.73



 Chicago, Illinois	TITLE			SAMPLE LOCATIONS	
	CLIENT/PROJECT	DRAWN	DATE	JOB NO.	
OMC/UST/IL	APS	10/1/97	973-8334		
	CHECKED	SCALE	FIGS. NO.		
	PLA	AS SHOWN			
	REVIEWED	FILE NAME	FIGURE NO.		
	PLA	83340001	1		

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**ATTACHMENT B**

**DOCUMENTS FROM OMC TO USEPA  
REGARDING WAUKEGAN MANUFACTURED  
GAS & COKE PLANT SITE  
THAT WERE NOT INCLUDED IN THE  
ADMINISTRATIVE RECORD UPDATE #3  
DATED FEBRUARY 19, 1999**

**DOCUMENTS FROM OMC TO USEPA REGARDING  
WAUKEGAN MANUFACTURED GAS & COKE PLANT SITE  
THAT WERE NOT INCLUDED IN THE ADMINISTRATIVE RECORD  
UPDATE #3 DATED FEBRUARY 19, 1999**

<b>#</b>	<b>Date</b>	<b>Author</b>	<b>Recipient</b>	<b>Title/ Description</b>
1	8/1/90	D. Jeffrey Baddeley	Cindy Nolan, USEPA	Waukegan Coke Plant Site
2	10/5/90	Glen E. Lenzi	Cindy Nolan, USEPA	Historical Photo
3	2/7/92	J. Roger Crawford	Cindy Nolan, USEPA	Coke Plant Site Access
4	2/20/92	J. Roger Crawford	Sean Mulroney, USEPA	OMC's Response to the Unilateral Administrative Order Dated February 13, 1992
5	8/31/95	Tricia Sutton	Lawrence Schmitt, USEPA	Waukegan Manufactured Gas & Coke Plant Site – Utility Corridor & Emergency Electrical Cable Replacement
6	9/18/95	J. Roger Crawford	Lawrence Schmitt, USEPA	Waukegan Manufactured Gas & Coke Plant Site Remedial Investigation Report Transmittal of Technical Review Comments
7	2/21/96			Comprehensive Environmental Response, Compensation & Liability Act Information System : GM COKE PLT
8	3/6/96	Maribeth Flowers	Sean Mulroney, USEPA	Waukegan Manufactured Gas and Coke Plant Site/Waukegan Harbor Site – Site Identification
9	3/6/98	Lisa Bongiovanni	Mike Bellot, USEPA	OMC Waukegan Plant No. 1 Parking Lot Expansion
10	3/17/98	Lisa Bongiovanni	Mike Bellot, USEPA	Sampling Plan Revision – OMC Waukegan Plant No. 1 Parking Lot Expansion
11	3/19/98	Marc Willis	Mike Bellot, USEPA	Schedule & Sampling Plan Revisions – OMC Waukegan Plant No. 1 Parking Lot Expansion
12	5/28/98	Marc Willis	Mike Bellot, USEPA	Data Summary of the Analytical Results from the Parking Lot Expansion Soil Sampling



OUTBOARD MARINE CORPORATION

100 Sea-Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 708-689-6200  
Telex 025-3891

Direct Dial: (708) 689-5431  
Telecopier: (708) 689-6241

August 1, 1990

018

Ms. Cindy Nolan  
U.S. Environmental Protection Agency  
230 South Dearborn Street  
Chicago, Illinois 60604

RECEIVED  
AUG 02 1990  
OMC ENVIRONMENTAL  
CONTROL DEPT.

Re: **Waukegan Coke Plant Site**

Dear Ms. Nolan:

The purpose of this letter is to advise the U.S. Environmental Protection Agency of the status of Outboard Marine Corporation with respect to the "good faith" offer for performing investigatory activities for the area known as the "Coke Plant Site" in Waukegan, Illinois. This area is bounded by Outboard Marine Corporation's Plant Nos. 1 and 2, and the Waukegan Harbor.

Outboard Marine Corporation has endeavored to assist in the organization of a response to your demand for an offer to perform the indicated work. We have met with representatives of the Agency, General Motors and North Shore Gas Company on several occasions. Outboard Marine Corporation has cooperated in every way in facilitating the submission of a good faith offer. Outboard Marine Corporation has provided extensive documentation to Barr Engineering, General Motors and North Shore Gas, and reviewed with these parties and the EPA the status of investigations being conducted as part of the Waukegan Harbor PCB remedial action.

We understand that General Motors and North Shore Gas Company are intending to submit a "good faith" offer to the U.S. Environmental Protection Agency by Wednesday, August 1, 1990. Outboard Marine Corporation was first provided with a briefing by Barr Engineering on the technical elements of the proposal on Monday, July 30, 1990. While we have discussed proposed financial terms of Outboard Marine Corporation's participation in the proposal being submitted, we are not privy to its details and have not received a response from North Shore Gas or General Motors as to whether our counter proposal for participation will be acceptable.

Ms. Cindy Nolan

-2-

August 1, 1990

Outboard Marine Corporation, therefore, wishes to preserve its rights to respond independently to EPA in the event there is not an acceptable resolution of the good faith proposal or the participation in that proposal by Outboard Marine Corporation.

We appreciate your cooperation in this matter.

Very truly yours,

D. Jeffrey Baddeley  
Associate General Counsel  
and Secretary

DJB:jm

cc: Sean Mulroney, Esq.  
✓ Roger Crawford  
Jeffrey C. Fort, Esq.



OUTBOARD MARINE CORPORATION

Outboard Marine Corp.  
2000 North Lincoln Road, P.O. Box 210  
Chicago, IL 60620  
Phone: (312) 613-0200  
Telex: 025-3321

October 5, 1990

Ms. Cindy Nolan  
Remedial Project Manager  
USEPA  
Region V  
Office of Superfund - MC5H511  
230 South Dearborn  
Chicago, IL 60604

Dear Cindy:

Enclosed, please find a photocopy of the postcard that we had discussed in our October 3, 1990 telephone conversation.

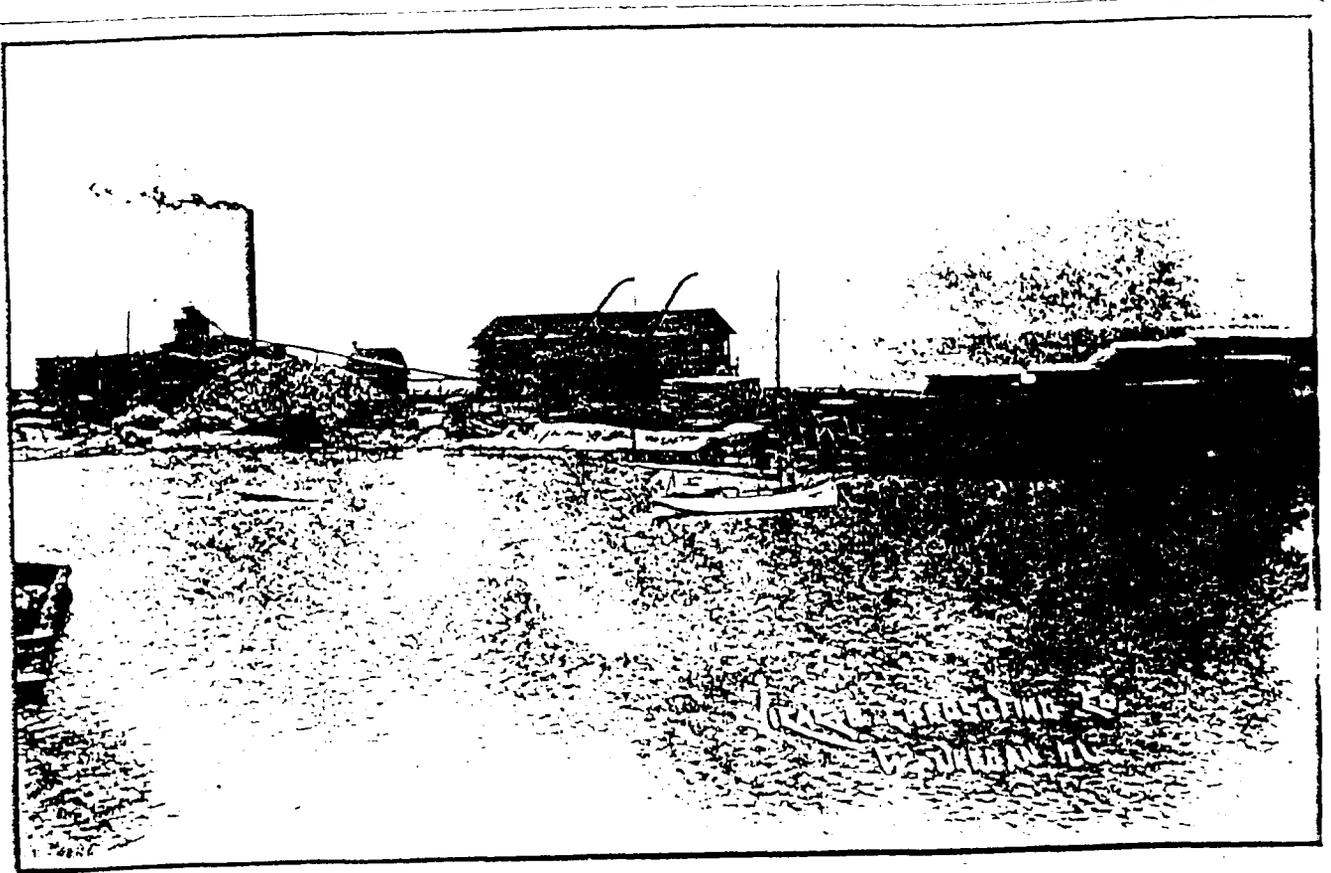
The original photograph is available for viewing at the Waukegan Historical Society.

Sincerely,

OUTBOARD MARINE CORPORATION

Glen E. Lenzi  
Environmental Specialist

GEL/is  
Encl.  
CC: Scott Moyer  
Tim Harrington



W. S. HARRIS & CO.  
SHEPHERDSON, N.C.

COPY

OMC

OUTBOARD MARINE CORPORATION

100 South Main Street  
Waukegan, Illinois 60087  
Phone: 815/491-1000  
Telex: 251391

February 7, 1992

Ms. Cindy J. Nolan  
Remedial Project Manager  
United States Environmental  
Protection Agency  
Region 5  
77 West Jackson Boulevard  
Chicago, Illinois 60604-3590

RE: Coke Plant Site Access

Dear Cindy:

This letter is written in response to your letter, dated February 4, 1992, ordering Outboard Marine Corporation ("OMC") to provide full and unequivocal access to the Waukegan Manufactured Gas and Coke Plant Site ("Coke Plant Site") for both the United States Environmental Protection Agency ("USEPA") and the North Shore Gas Company ("North Shore Gas") by 12:00 noon on Friday, February 7, 1992, or face a USEPA order compelling access. Your letter raises a number of issues which merit a response and requires the recitation of some historical background on this matter.

First, implicit in your letter is the suggestion that somehow OMC is ultimately responsible for North Shore Gas' current failure to secure access to the Coke Plant Site. Such an implication is entirely erroneous. In fact, OMC has consistently stated its intention to allow North Shore Gas access to the Site. It was North Shore Gas that took almost a full year to respond to OMC's executed access agreement. It was also North Shore Gas that had a USEPA approved work plan in November of 1991 requiring commencement of site activities on January 6, 1992, yet came to OMC for the first time on January 2, 1992 to discuss significant outstanding issues regarding access to the Coke Plant Site. It is for these reasons we are discussing access at this seemingly late date.

RECEIVED

FEB 12 1992

OMC ENVIRONMENTAL  
CONTROL DEPT

Ms. Cindy J. Nolan  
February 7, 1992  
Page 2

OMC, from the beginning, has displayed nothing but a complete willingness to cooperate in and expedite the resolution of this matter. Neither USEPA nor OMC expected to uncover contamination at the Coke Plant Site. Nonetheless, upon discovery and despite the clear link of the identified contaminants to former coking operations conducted by past owners of the parcel, OMC, at great expense, diligently proceeded with additional soil sampling and analysis to determine the nature and extent of contamination in an effort to continue progress on work under the Waukegan Harbor Site cleanup ("Harbor cleanup").

Subsequently, USEPA identified OMC, North Shore Gas and General Motors Corp. ("GM") as potentially responsible parties ("PRPs") at the newly designated Coke Plant Site and requested the submittal of a "good faith" proposal to conduct a remedial investigation/feasibility study ("RI/FS") at the Site. OMC attempted to participate in the development of the good faith proposal despite having conducted no manufacturing operations at the Site and despite the fact that the identified contaminants in no way were related to OMC's manufacturing operations at its Waukegan facility. OMC provided North Shore Gas and its consultant with all documents generated during its independent analysis of the contamination identified at the Coke Plant Site and information concerning the status of the Harbor cleanup. North Shore Gas, however, failed to reciprocally cooperate and, in fact, provided OMC with only scant details of the technical elements of the good faith proposal prior to the deadline for submission to USEPA.

Ultimately, OMC offered to participate in the RI/FS proposal and to allow full and complete access to the Coke Plant Site for the purpose of carrying out all necessary activities to accomplish the RI/FS. North Shore Gas and GM rejected OMC's offer of assistance, thereby creating an obligation to procure a site access agreement from OMC. Subsequently, North Shore Gas independently entered into an Administrative Order on Consent ("AOC") to conduct the RI/FS at the Coke Plant Site.

After entry of the AOC, North Shore Gas requested access to the Coke Plant Site, and OMC responded in a letter to counsel to North Shore Gas, dated September 10, 1990, by D. Jeffrey Baddeley, Associate General Counsel and Secretary of OMC. That letter reiterated OMC's request originally made by OMC's outside counsel, Richard Kissel, for a proposed written access agreement from North Shore Gas.

Ms. Cindy J. Nolan  
February 7, 1992  
Page 3

On January 29, 1991, almost five full months after its original request for a written agreement, OMC received North Shore Gas' first draft of an agreement for access to the Coke Plant Site. In order to expedite matters, on February 18, 1991, OMC submitted to North Shore Gas an executed copy of a revised access agreement for North Shore Gas' approval. Despite receiving no written response to the executed agreement, OMC continued to accommodate North Shore Gas' efforts at developing an RI/FS work plan, allowing North Shore Gas and its consultant access to the Coke Plant Site on May 31, 1991 for the purpose of conducting a site inspection.

OMC received no written response to the February 18, 1991 executed agreement until January 2nd of this year, almost eleven months from receipt by North Shore Gas of OMC's executed draft and a year and a half after North Shore Gas' obligation to secure access arose. In November of 1991, USEPA approved the RI/FS work plan which required North Shore Gas to begin site work on January 6, 1992. The January 2nd letter transmitting North Shore Gas' response to OMC's outstanding agreement requested that a meeting be held the very next day to discuss the matter. While schedules prevented a January 3, 1992 meeting, OMC did meet with North Shore Gas on the next business day, January 6, 1992, to discuss the matter.

At the January 6th meeting, OMC was informed for the first time that North Shore Gas had submitted and USEPA had approved the RI/FS work plan for the Coke Plant Site. The work plan provided that the RI/FS would be conducted over a two-year period and include two phases of soil and groundwater investigations at the Coke Plant Site. Technical documents, including the Field Sampling Plan and the Health and Safety Plan, identifying the breadth and exact location of these sampling efforts, were not made available to OMC at the January 6th meeting and were not received until January 13, 1992, and then only after a request from OMC.

Since that meeting, OMC has again devoted significant time and resources not only to reviewing the substantial work plan documents, but also to negotiating with North Shore Gas regarding conditions of access. As it stands now, OMC and North Shore Gas have reached an agreement on all but a few critical outstanding issues. Your suggestion that the presence of "few physical constraints" at the Site should not require so much effort in securing access greatly oversimplifies the issues involved and ignores the complexities associated with the commencement of independent Superfund cleanups on one

Ms. Cindy J. Nolan  
February 7, 1992  
Page 4

parcel of property as well as the problems already encountered during the Harbor cleanup.

First and foremost, the commencement of work at the Coke Plant Site will in effect result in two Superfund site remediations being conducted on one parcel of land. Such a situation is unprecedented. It would be irresponsible for OMC not to ensure that the presence of North Shore Gas on OMC's property does not interfere with remedial activities conducted under a Consent Decree which mandates adherence to prescribed time schedules and exposes OMC to potential penalties for failure to comply with such schedules.

In addition, as you are well aware, remedial activities at the Waukegan Harbor Site have entered an extremely critical stage. The dredging and treatment of harbor sediments is in full swing. Any interference with or interruption of these operations for any length of time will severely compromise the Waukegan Harbor Trust's ability to adhere to the existing schedules and also result in substantial additional costs to OMC. This matter is not a hypothetical situation inasmuch as OMC has already been forced into disputes with the Waukegan Harbor Trust and its contractor for additional costs associated with prior delays in work schedules. Any access provided to the Site must include reasonable measures to prevent interference and avoid these consequences.

Second, as you are also aware, the Occupational Safety and Health Administration ("OSHA") has recently issued citations to OMC and others at the Waukegan Harbor Site for failure to comply with certain training, personal protection, decontamination and site security measures. These citations involve Site activities which were actually conducted in compliance with USEPA's approved Health and Safety Plan. More importantly, OMC was cited by OSHA, in its capacity as owner of the property, for the alleged failure of subcontractors present on-site in furtherance of the Harbor cleanup to comply with their OSHA obligations.

OSHA has yet to provide OMC with a final response regarding what activities, if any, being conducted in and around the Waukegan Harbor Site must conform to increased OSHA regulations. Any licensee entering OMC's property would consequently expose OMC to additional citations. Until this issue is resolved or until OSHA approves the on-site activities of licensees, including North Shore Gas, OMC cannot allow access.

Ms. Cindy J. Nolan  
February 7, 1992  
Page 5

Finally, the Coke Plant Site, as presently defined, includes within its boundaries OMC's Data Processing Center serving the Company's world wide operations. The importance of these operations to the Company cannot be overstated. As such, due care must be taken to protect the sensitive computer operations from harmful interferences which may result from intrusive remedial activities conducted in proximity to these operations. Again, OMC is entitled to and must insist upon assurances that these operations and other operations of OMC necessary at the Site will not be adversely impacted by site activities. Further, it has also been noted that OMC is in the process of conveying a portion of its property which falls within the confines of the Coke Plant Site to Larsen Marine Services. Obviously, OMC has no authority to allow access to that portion of the Site subject to the conveyance.

In sum, at every stage of the proceedings, OMC has acted reasonably and in good faith to accommodate USEPA's recent urgings and provide North Shore Gas with appropriate access to the Coke Plant Site. When North Shore Gas rejected OMC's good faith offer back in September of 1990, it knew that executing an access agreement with OMC was necessary. North Shore Gas also knew in November of 1991 that it was obligated to commence on-site activities on January 6, 1992. It failed to take the necessary steps to secure such access. Instead, North Shore Gas waited until two business days before its January 6th deadline to begin serious negotiations to obtain access. Even then, OMC was not provided with the critical technical documents detailing the nature and extent of North Shore Gas' proposed on-site activities until January 13, 1992. Two weeks have passed and now USEPA is threatening OMC with orders to compel access.

Notwithstanding these facts, OMC will continue to devote, as you urge, immediate attention to this matter. OMC continues to work with North Shore Gas on the outstanding issues which remain and is hopeful that a resolution of North Shore Gas' access to the Coke Plant Site can be achieved. OMC does have serious reservations regarding its ability to resolve the OSHA issues without the assistance and intervention of USEPA. Contrary to your assertions in our January 30, 1992 meeting that USEPA has full and exclusive health and safety plan approval authority at a National Priorities List site, I was recently advised that the Army Corps of Engineers is attempting to verbally modify the Waukegan Harbor Site Health and Safety Plan and are required to ultimately report to OSHA other parties' adherence to the verbally revised plan.

Ms. Cindy J. Nolan  
February 7, 1992  
Page 6

I was forewarned of USEPA's verbally aggressive posture against OMC in this matter. Nevertheless, I am surprised that USEPA's efforts have apparently been focused more on OMC than North Shore Gas. OMC, however, is not at fault here and has been neither dilatory nor unreasonable in its insistence upon imposing certain conditions upon access to the Coke Plant Site. If any blame is to be meted out here, it must fall solely and squarely on North Shore Gas.

If you have any comments or would like to discuss the status of this matter in greater detail, please call me.

Very truly yours,



J. Roger Crawford  
Corporate Director,  
Environmental Affairs

JRC/lbm

cc: Russell B. Selman, Esq.  
Sean Mulroney, Esq.

9678w



OUTBOARD MARINE CORPORATION

100 Sea Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 708 689 6200  
Telex 025 3891

February 20, 1992

Sean Mulroney  
Assistant Regional Counsel  
United States Environmental Protection Agency  
Region 5  
77 West Jackson Boulevard  
Chicago, Illinois 60604-3590

Dear Mr. Mulroney:

This letter is written as OMC's response to the Unilateral Administrative Order (the "Order"), dated February 13, 1992, issued by USEPA pursuant to Section 104(e)(5) of the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, ("CERCLA"), compelling access to the Waukegan Manufactured Gas and Coke Plant Site ("Coke Plant Site") for USEPA, including its designated representative, the North Shore Gas Company and its contractors, for the purpose of implementing a work plan identified in the Order. It is OMC's intent, as further provided in the letter, to permit the access to the Coke Plant Site requested by USEPA for itself and its designated representatives.

By allowing the access requested in the Order, OMC does not admit any of the Findings of Fact and Determinations of Law contained in the Order. Indeed, OMC specifically objects to the following findings and determinations made by USEPA in the Order:

1. OMC restates its objection to USEPA's definition of the Coke Plant Site. Under USEPA's characterization of the Coke Plant Site, as provided at Paragraph C of the Findings of Fact, OMC's manufacturing Plant No. 1 and the City of Waukegan Waterworks may be inappropriately included within the boundaries of the Coke Plant Site.

2. OMC disputes the allegation set forth at Paragraph E of the Findings of Fact that its acquisition of the Coke Plant Site in 1971 and subsequent dismantling of the plant structures by OMC resulted in the disposal of "some waste material on-site." Any responsibility for contamination at the Coke Plant Site can only be attributed to North Shore Gas, the General Motors Corporation and other owners and operators of the Site.

3. Paragraph N of the Findings of Fact states that OMC, in its last draft of the license agreement being negotiated between OMC and North Shore Gas, introduced "inappropriate limitations on USEPA's authority" thereby effectively denying USEPA access to the Coke Plant Site. OMC disagrees with this characterization by USEPA. In negotiating acceptable terms to allow USEPA's representatives access to and use of the Site, OMC has attempted to create a mechanism for its participation in consideration of the appropriate methods for effectuating USEPA's remedial activities. OMC has sought to participate in this process in an effort to protect its critical operations being conducted at the Site from USEPA interference and damage. OMC, however, has never attempted to limit in any way USEPA's ability or authority to conduct activities at the Coke Plant Site authorized under Section 104(e) of CERCLA.

OMC has also proposed in its most recent draft license agreement a method for resolving conflicts arising as a result of the commencement of Superfund remedial activities at the Coke Plant Site and the Waukegan Harbor Site. The proposed language does not limit USEPA's authority at these Superfund sites, but, in fact, attempts to empower USEPA with ultimate authority for the resolution of all of these potential conflicts.

4. OMC is without any authority to comply with Paragraph F of the Order concerning the limitations on conveyance of property interests located within the Coke Plant Site. Currently, OMC is in the process of satisfying an outstanding obligation to convey to Larsen Marine Services, Inc. ("Larsen") a portion of the Coke Plant Site. This obligation arose as part of a Settlement Agreement executed by OMC and Larsen in February of 1991 in furtherance of remedial activities being conducted at the Waukegan Harbor Site under a Consent Decree signed by the USEPA. OMC, therefore, has no legal authority to impose any subsequent conditions on this conveyance.

Notwithstanding these objections and OMC's general reservation of rights, OMC will allow access to USEPA, its designated representative North Shore Gas and its contractors, to the Coke Plant Site for the purpose of implementing the work plan referred to in the Order as follows:

1. Access to the Coke Plant Site will be provided for the sole purpose of conducting all activities necessary to implement site work under the Statement of Work For Conducting a Remedial Investigation and Feasibility Study at the Waukegan Manufactured Gas & Coke Plant Site ("Work Plan").
2. USEPA agrees not to proceed or allow its designated representatives to proceed with the Work Plan activities to the extent that any conflict arises between any Occupational Safety and Health Administration ("OSHA") determination that may trigger subsequent OSHA requirements for OMC, the Waukegan Harbor Trust, Larsen or North Shore Gas and the USEPA approved Work Plan.
3. OMC agrees to continue to use due diligence and its best efforts to satisfactorily resolve all of OSHA's concerns with respect to conflicts that arise with OMC operations as a result of any OSHA determinations.
4. Prior to the commencement of site work under the Work Plan, USEPA shall deliver to North Shore Gas and OMC a letter setting forth procedures for the coordination of activities at the Coke Plant Site and the Waukegan Harbor Site.
5. In addition, USEPA, North Shore Gas and OMC shall use their best efforts to resolve any other conflicts in site activities and the operations of OMC in and around the Coke Plant Site to the

satisfaction and accommodation of all of the parties. If the parties fail to resolve these conflicts, such disputes shall be presented to USEPA's Project Manager(s) designated at the Coke Plant Site for final resolution.

6. By allowing the access requested in the Order, OMC does not waive any of its rights and defenses available under any legal authority to challenge any actions of USEPA and its representatives at the Coke Plant Site, nor does OMC limit or waive any potential rights or actions for compensation or restitution pursuant to any remedy in law or equity.

By receipt of this letter, USEPA acknowledges that OMC will comply with USEPA's Unilateral Administrative Order as set forth in this letter.

OUTBOARD MARINE CORPORATION

  
Director, Environmental Control



UTBOARD MARINE CORPORATION

100 Sea-Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 708/689-6200

31 August 1995

Mr. Lawrence Schmitt  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 W. Jackson Boulevard HSRL-6J  
Chicago, IL 60604-3590

**RE: Waukegan Manufactured Gas & Coke Plant Site  
Utility Corridor & Emergency Electrical Cable Replacement**

Dear Larry:

As a follow-up to our telephone conversation on August 28, 1995, I am providing additional details on OMC's urgent need to proceed with the replacement of a high voltage underground cable which is located in an existing utility corridor along the eastern edge of the former Coke Plant property. The electric cable, installed without conduit in the early 1970's, provides power to OMC's world-wide Data Processing Center, Environmental Affairs building, and the Plant # 1 manufacturing facility. The cable has failed twice in the past two months and OMC has been advised by its contractors that the line must be replaced in order to insure maintenance of this vital service. Our Plant Engineering Department wants to proceed with the work on or about September 11, 1995. The project is expected to be completed in about four weeks.

As we initially discussed, OMC's engineers had requested to relocate the line to the west of the Data Processing building in order to avoid installation complications related to other utilities located in the vicinity of the existing cable. After further consideration, however, OMC has decided that the additional costs associated with installing the replacement electrical service adjacent to its existing location are necessary to avoid the highly contaminated former coke plant manufacturing and processing areas.

Following our discussion today, I inquired into the possibility of rerouting the electric service further east, off OMC property outside and to the east of the existing utility corridor. I was advised that conflicts would arise with the City of Waukegan sewer and water utilities that are located in or adjacent to Sea-Horse Drive. Based on review of data in the site Remedial Investigation report, these areas are also likely to contain low-level contaminants similar to the existing on site utility corridor and would not avoid the need to provide service across the property to the existing OMC buildings. In addition, the routing now proposed is adjacent to and predominantly east of the sanitary sewer force main which USEPA previously approved for construction in the Waukegan Harbor project.

Enclosed is a drawing which shows the proposed location of the utility lines and an example section through the trench. The trench would be excavated to about 36 to 48 inches deep, which is at or above the groundwater table. Three five-inch diameter PVC conduits will be placed into the trench. The two additional conduits will be used for the future replacement of existing telephone cables which are also located in the utility corridor.

OMC is providing a copy of the 'Project Health and Safety Plan' prepared by Barr Engineering for the RI and the relevant RI data tables to the project contractors to alert them to the safety considerations. In addition, the contractors are to provide documentation of their employees' qualifications under OSHA 1910.120. I will provide you copies of what OMC receives.

Note that I spoke with Jerry Picha of North Shore Gas briefly yesterday on this matter and, by copy of this letter, OMC is also notifying North Shore Gas of the work. OMC requests US EPA's input on this project as soon as possible due to the urgency of the electric power problem. If you have any questions, please feel free to call me at 708/689-5228.

Sincerely,



Tricia Sutton  
Senior Environmental Specialist

enclosure

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c: Steve Armstrong, North Shore Gas  
Patrick Doyle, North Shore Gas (w/out encl.)  
Roger Crawford, OMC (w/out encl.)  
Maribeth Flowers, OMC (w/out encl.)  
Richard Kissel, Gardner, Carton, & Douglass



UTBOARD MARINE CORPORATION

100 Sea-Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 708 689-6200

18 September 1995

Mr. Lawrence Schmitt  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 W. Jackson Boulevard HSRL-6J  
Chicago, IL 60604-3590

RE: Waukegan Manufactured Gas & Coke Plant Site  
Remedial Investigation Report  
Transmittal of Technical Review Comments

Dear Mr. Schmitt:

Enclosed are technical review comments which address the **Waukegan Manufactured Gas & Coke Plant Site Remedial Investigation Report** dated February, 1995. The technical review was performed by representatives of Ann Arbor Technical Services Inc. (ATS), Residuals Management Technology, Inc. (RMT) and the OMC Environmental Affairs Department. Earlier this summer we met with representatives of the North Shore Gas Company and General Motors and attempted to begin a dialogue concerning our initial review of the Report; however, our initial review offer was rejected by the other parties.

Based on our current understanding of the information presented in the Report, we believe that critical deficiencies and/or uncertainties exist. First, the nature and extent of the site contamination has not been adequately defined. The available data suggest that there is an on-going contaminant release from source areas in the site. Second, we believe that additional work needs to be undertaken to better establish the routes of human and environmental exposure associated with the site. It is extremely important that the deficiencies and uncertainties be addressed before the risk assessment work is completed, otherwise, the information base is likely to be insufficient to identify and assess potential remedial options for the site.

After you have completed your review of our comments, we would welcome the opportunity to meet with you and the other parties at interest. Please contact me at 708/689-5219 or Tricia Sutton at 708/689-5228 if you have any questions concerning the comments or wish to schedule a meeting.

Sincerely,

A handwritten signature in cursive script, appearing to read "J.R. Crawford".

J. Roger Crawford, P.E.  
Director, Environmental Affairs

cc: Steve Armstrong, North Shore Gas  
D. Jeffrey Baddeley, OMC  
Patrick Doyle, North Shore Gas  
Maribeth Flowers, OMC  
Richard Kissel, Gardner, Carton, & Douglass  
James R. Langseth, Barr Engineering  
Jerome I. Maynard, Dykema Gossett  
Russell B. Selman, Katten, Muchin & Zavis  
Phillip B. Simon, ATS  
Tricia Sutton, OMC

**TECHNICAL REVIEW COMMENTS**

submitted by: Outboard Marine Corporation  
September 18, 1995

concerning the  
**REMEDIAL INVESTIGATION REPORT:**

Waukegan Manufactured Gas and Coke Plant (WCP) Site  
Waukegan, Illinois

Prepared for: North Shore Gas Company by Barr Engineering Company  
February 1995

OMC is submitting technical comments based on a detailed review of the Remedial Investigation (RI) Report for the Waukegan Manufactured Gas and Coke Plant (WCP) Site for USEPA's consideration in completing the RI/FS for the site. Although there is not a formal public comment period underway at this time, OMC believes the concerns discussed are relevant to successful completion of the RI/FS and proper selection of a remedial action for the site. Therefore, it is appropriate to provide USEPA and the parties conducting the RI the opportunity to address the concerns in upcoming phases of work prior to remedy selection.

The WCP RI Report presents a large volume of site assessment data; however, it presents surprisingly little detailed evaluation of that data with respect to the extent, sources, fate, and environmental impact of the extensive contamination identified. The Report presents little detail on coking and wood treating operations and no more than a brief discussion of waste types potentially associated with these site operations (Sec. 2.1.4). Furthermore, it neglects to relate the constituents and patterns of contamination present at the site to the substantial historical manufacturing operations.

OMC takes strong exception to many statements that misrepresent OMC's role on site and speculate upon the source of the site contaminants. OMC's activities at the WCP site have been very limited compared to the key industrial operations which are directly associated with the contamination found at the site. There is also a disproportionate amount of detail on the Waukegan Harbor Superfund Remedial Action which is not related to the contamination identified at or the history of the WCP site. While some of this emphasis may be due to limited information available regarding historical activities, it is inconsistent for such an investigation to elaborate on minimal on site and unrelated nearby activities while practically ignoring the impact of the primary historical industrial operations. At this time, OMC chooses to focus its comments on technical limitations of the study, rather than elaborate on such statements found throughout the RI.

The following sections present specific concerns on the adequacy of the collection and interpretation of the data gathered during the RI that are critical to making appropriate remedial decisions for the site, including:

- inadequate identification of the nature of contamination;
- incomplete characterization of certain physical site features;
- inadequate evaluation of existing residual waste sources, the potential for continued release, and pathways for migration of site contaminants;
- incomplete definition of the extent of contamination; and
- implications of transport and migration of site contaminants to Waukegan Harbor and Lake Michigan.

OMC is providing comments to foster communication between the involved parties and facilitate the decision-making process and requests the comments be given consideration at this time.

## I. NATURE OF CONTAMINATION .

The study did not adequately identify the suite of site contaminants (Sec. 6.0). Although "key parameters" related to site contamination were investigated, no attempt was made to characterize the complex mixtures of inorganic and organic chemicals that would have resulted from the manufacturing operations of the North Shore Coke and Chemical Company. Without such characterization, it is not reasonable to conclude that the "key parameters" used in the RI are appropriate indicators of the extent and magnitude of contamination at the site.

A list of "potential chemicals of concern" (Sec. 4.0, pg. 35) was developed before commencing remedial investigation activities at the site, largely on the basis of information in the literature concerning coking and wood treating processes. The initial phase of the RI employed standard USEPA testing methods to measure the concentration, if any, of standard target compounds in groundwater and soils. A subsequent, shorter list of "key parameters" (Table 6.1.1) was assembled to evaluate impact at the site. This shorter list was compiled by selecting only those compounds that were both standard USEPA target compounds and that had been found at the site during the initial phase of the remedial investigation (Appendix 6-A, pg. 6-A-1). A limited number of "site specific compounds" were added to the target compound list (e.g. ammonia and thiocyanate) based on the likelihood of finding these compounds as waste constituents of coking operations (Appendix 6-A, pg. 6-A-4).

Other "site specific" parameters were added to this list because they had been identified by previous investigators as being contaminants of interest in and around Waukegan Harbor (Sec. 4.0, pg. 38, para. 1). For example, PCB 1248 is carried through the RI as a key parameter to characterize the extent of soil, groundwater, and surface water contamination in the vicinity of the site (as listed in Table 6.1-1). PCB 1248, however, was detected in only a limited number of samples, with all detections at relatively low levels. Section 6.1 states that "PCBs were added to the key parameter list because of their association with on site operations..."; however, the report later concludes in Section 7.2 that "It is reasonable to conclude from the soil and groundwater sampling

that PCBs are not widespread at the WCP site." While it may have been appropriate to screen the site for PCBs initially, the inclusion of PCBs as a key parameter is not consistent with the treatment of similar contaminants that have only limited occurrence at the site.

As the study progressed from field investigation to data evaluation and analysis, the list of chemicals of concern was narrowed further, culminating in the identification of arsenic, cyanide, BTEX aromatics, polynuclear aromatics and phenols as being key site contaminants. While this approach is adequate for demonstrating the presence of impact from a contaminant source known to contain the indicator parameter(s), it is not adequate for determining the extent of impact from a contaminant source of unknown composition. The absence of these "key contaminants" at a given location on site is not, by itself, enough to assure that contamination is not present. It is first necessary to establish that those selected "key contaminants" correlate with all other environmentally significant contaminants present at the site, both in the source materials and in materials which have been contaminated with residues from the source materials (hereafter called "impact residues"). To utilize a shorter list of "key contaminants" as indicators, it is further necessary to establish that the selected contaminants will be representative of the overall occurrence and migration of the site's contaminant suite. The most comprehensive approach is to identify the composition of the waste constituents in the source areas, using special analytical services if necessary (e.g. USEPA CLP "Level V" Special Analytical Services), and compare this composition to the composition of impact residues to establish which of the waste constituents can best serve as indicators of impact.

The Report acknowledges that the site had a long history (1927-1941) of producing chemicals, as the North Shore Coke and Chemical Company (Sec. 2.1.3.3, pg. 8). The Report also acknowledges that in addition to specific inorganic chemicals (sulfur, sulfate, ammonia), and specific organic chemicals (naphthalene), the company produced complex organic mixtures like creosote and coal tars, which are composed of literally hundreds of individual organic compounds (Sec. 2.1.4, pg. 12). No attempt was apparently made, however, to identify the specific composition of these mixtures as they occur on site in waste deposits and impact residues. No consideration was given to classes of compounds other than hydrocarbons (e.g. pyrolytic oxygenates such as aldehydes and ketones), in selecting "key compounds". Many of these organics surely would have shown up as non-target "unknown" peaks in the mass chromatograms for USEPA organic screening analyses. At sites with residues from chemical operations, such unknowns often constitute a much greater percentage of the waste residue than do the standard target compounds, yet the report does not address them at all.

The Report does not adequately address the issue of the primary historic source areas and the release of historic process wastes. Conversely, the Report contains an abundance of speculation regarding the potential impact of the relatively limited activities OMC undertook on the site. A "typical" process flow chart is presented in Figure 2.1-3, showing the numerous elements of product generation and recovery in a manufactured gas/coke plant. While this diagram appears to be relevant to the WCP, and provides useful information on the raw materials used and the products generated, it is incomplete -- particularly with respect to probable waste streams. The only waste product referenced in the process diagram is ash from the gas producer and boiler house. In addition, while it is apparent from this figure that water was used to generate steam, the diagram does not reflect the fact that substantially more water was probably used in the coke quenching portion of the operation. The coke

quenching process is shown in this figure, as well as on the historic facility layout (Fig. 2.1-2). While ponds and transite piping are also shown, the Report does not discuss the use of those hydraulic structures, nor mention the wastewater which was almost certainly discharged into them. Based on the nature of the coking and chemical processes, the wastewater would consist of aqueous wastes which were highly concentrated with residual chemicals that were not economically valuable. Such a complex, concentrated mixture would be much more dense than the groundwater and surface water at the site. This high density would complicate the mixing patterns at the site and create density or gravity driven gradients in addition to typical groundwater transport (through advection, dispersion, diffusion).

Given the probability that a major amount of the groundwater contamination at the site resulted from the flow of high-solute, high-density aqueous process streams, documenting the role of discharge structures would seem to be essential in understanding the contamination of the site. A more thorough analysis of the manufacturing processes, the probable waste streams that would have resulted, and the fate of those waste streams, would yield a much better understanding of the nature of the contaminants, the vectors of transport, and the impact on the various environmental receptors.

## II. PHYSICAL SITE FEATURES

### Lateral and Vertical Extent of Hydrogeologic Units Under Waukegan Harbor and Lake Michigan

The study failed to define how and where both the sand aquifer and clay till intersect Lake Michigan and Waukegan Harbor. Defining these stratigraphic relationships is important because it appears that contaminants at this site migrate as a function of both groundwater flow and density or gravity driven flow as discussed above under Heading I. However, the geology section (Sec. 5.1) does not extend cross sections of the unconfined aquifer materials out into Lake Michigan and Waukegan Harbor. Basically, the data are limited to the land surface of the peninsula that hosts the WCP site only, and show a sand aquifer that rests on a confining clay till unit with an irregular subcrop surface dipping gently to the east under Lake Michigan and to the south under OMC Plant #1 (Sec. 5.1 and Figure 5.1-5). The sand unit likely pinches out under Lake Michigan as the lake bottom elevation declines, which would mean that the underlying clay till comes in direct contact with the lake bottom some distance out from the shoreline. It is also unknown how the spatial characteristics of the clay till vary under the Lake and the Harbor; for example, whether the clay till unit changes in terms of its dip with distance away from the peninsula. This geologic feature is potentially important to understanding contaminant migration.

In addition, the logs for boreholes drilled on the public beach (Appendix 4-A, Soil Boring Logs SB-12D, SB-13D and SB-14D) reveal gray, dark gray and black zones with substantial organic vapor content. In some cases, there was sufficient organic vapor for the drillers to note "coal tar and phenolic odors". In one case (SB-12D), the gravel directly above the clay till was visibly black with contamination. It is possible that these sediments (as well as those that exist at an undefined distance further away from these boreholes and possibly a greater

distance out under Lake Michigan) act as continued sources of groundwater and, ultimately, surface water contamination. The stratigraphic hydrologic connections of the aquifer to the Lake and the Harbor therefore are important to defining migration pathways for the site and the risks these pathways pose.

A review of available literature should supply some information on this off-shore connection. Adding more extensive literature discussion of regional geology and hydrogeology on this issue to the RI report (Sec. 2.2.5) will help resolve concerns over this critical physical feature and the migration pathways. In addition, investigations that will be necessary to define the lateral extent of contamination (see Heading IV below) can also serve to help define the spatial relationships of these deposits.

#### Stratigraphic Variations Under the WCP Site

The investigation (Geology, Sec. 5.1) did not adequately delineate the extent of relatively shallow fine-grained deposits associated with former on site lagoons. Such fine-grained materials may control migration of contaminants away from the former lagoons. Fine-grained materials encountered in various borehole geologic logs (Appendix 4-A) and as described on trench logs (Appendix 4-D) as "Industrial Pond Deposits" were not discussed in the Report. These subsurface deposits are important in terms of delineating the vertical and lateral extent of remaining source materials. The spatial relationships of these source-related subsurface deposits should be investigated further by means of geophysical survey techniques and additional sampling. Data obtained should be rendered in three dimensions in order to facilitate review and implementation of potential remedial actions.

Although the report utilizes borehole data to contour the surface of this clay unit, the irregularities that contouring brings to light indicate that a more detailed understanding of that clay surface is necessary in order to fully evaluate the extent, fate, and transport of subsurface contaminants, especially dense aqueous and non-aqueous plumes. The report should have identified non-intrusive investigations needed to delineate site features in a recommendations section. A seismic refraction survey could be used to adequately characterize that portion of the clay surface that exists under the peninsula.

#### Groundwater Flow Systems

The study does not define the distance that groundwater in the deeper portion of the sand aquifer travels before discharging into Lake Michigan. The location of the groundwater discharge controls the migration and exposure pathways and the ecological effects of the contamination. In addition, this location may affect the mixing of groundwater and surface water. Therefore, such information should have been developed and related to the selection of surface water sampling locations.

Section 5.2.1.1 outlines the data on the relationship between groundwater flow and existing surface water levels; however, the influence they may have had on contaminant migration from waste discharge lagoons is largely ignored. While the Report suggests that temporal extremes in hydraulic gradient cannot be sustained by the groundwater flow system for long periods of time, the time frame for sustaining temporal extremes in hydraulic

gradient was not adequately determined. Data on seasonal and temporal changes are important when conducting computer simulations of contaminant transport through the aquifer and into the surface water bodies. Furthermore, data on long term (over the history of the site as well as seasonal) changes in lake levels should have been obtained and evaluated because there is evidence that waste discharge lagoons existed on-site for an extended period of time. These lagoons would have controlled and altered groundwater recharge zones on site. Steeper changes in hydraulic gradient would have been sustained over significant periods of time when the discharge lagoons were present. Although fluctuations in hydraulic gradients have less of an effect on contaminant migration at the present time, the fluctuations likely had a significant influence on the migration of contaminants while these lagoons existed. It would be normal for the hydraulic gradient to increase if Lake Michigan water levels lowered, while on the other hand, the groundwater hydraulic gradient should decrease if the lake level increased. The overall effects of such fluctuations in hydraulic gradient would be to facilitate the spread and mixing of groundwater contamination throughout the aquifer and into the surface water bodies. The effect of longer term steepening of hydraulic gradient due to the former discharge lagoons would have been to increase the distance off-shore that contaminants would have traveled relative to those gradients measured and simulated as part of the remedial investigation. These points were not discussed in the Report.

The groundwater elevation data are not adequate to determine the influence of seasonal fluctuations on groundwater flow. Water levels were sparingly collected in the fall and winter, but not in the spring and summer. Such seasonal changes may be significant in understanding rates and patterns of contaminant migration and the likelihood of future contaminant releases from residual sources.

The study does not accurately define where groundwater flow enters the site, and in some instances, inaccurately characterizes "upgradient" sources of groundwater. Well MW-15S is described as upgradient of the WCP site (Sec. 7.2, pg. 114, para. 3). MW-15S is only upgradient of a small portion of the northwest corner of the WCP site according to the groundwater contour maps contained in the Report. Section 7.7.1.1.3 (pg. 136, the last paragraph) suggests that wells MW-4S and MW-11S are located upgradient from the site. MW-4S is clearly not upgradient of the site, but is located along the groundwater divide in the central part of the site. In that location, groundwater flow and any contaminants migrating with it would predominantly be derived from the WCP site. Furthermore, well MW-11S is located in the extreme northwest corner of the WCP site, and is more cross-gradient to the site. Section 7.7.1.2.1 (the last sentence of pg. 140) further states that well MW-5S may be influenced by off-site activities. Well MW-5S appears to be downgradient of only the WCP site based on the groundwater contour maps supplied in the Report.

#### Groundwater Flow Modeling via Computer Simulation

The computer modeling completed was not adequate to predict the migration of contaminants into Lake Michigan and Waukegan Harbor. The Report details the preparation and calibration of a two-dimensional, analytical aquifer computer model "SLAEM" which is to be used to gauge the efficacy of possible future hydrogeologic efforts intended to remediate groundwater contamination existing within a near-surface, unconfined drift aquifer found beneath the property (Appendix 8-A; Sec. 8.4.4). The SLAEM model can only approximate the performance of any planned remedial actions that do not act fully upon the entire thickness of

the contaminated aquifer (25.5 feet on average). In these instances, a three-dimensional model is required. Depending upon the kind of remedial measures proposed, this may be a serious constraint on the utility of the model in designing remedial measures.

The RI makes considerable effort to define the input parameters (hydraulic conductivity, hydraulic gradient, and aquifer thickness) to the computer model by means of the placement of numerous borings over the site and the installation and testing of many observation wells. Based upon analyses of all of these results, the hydraulic conductivity of the aquifer was determined to range from 6 to 96 feet per day. In spite of this range, the modeling assumes an average hydraulic conductivity for the entire aquifer of 30 feet per day. Aquifer characteristics determined from the distance-drawdown relationship during the aquifer performance test were apparently ignored for this evaluation. Hydraulic conductivity was computed to be 16.3 feet/day with a storage coefficient of 0.089 from the distance-drawdown relationship which are very reasonable figures for this unconfined sand aquifer. It could be argued that this value of hydraulic conductivity is representative only of the aquifer modeling immediately surrounding the pumping well, yet the Report ascribes a single average value to this aquifer across the whole site.

A preferred method for defining input data for the SLAEM model that was used would have been to contour the spatial distribution of the results to determine whether a coherent pattern of hydraulic conductivity exists, and then ascribe these various values in the model to the appropriate section of the aquifer. The Report should have contained a discussion of additional computer modeling that is needed to help guide future investigations as well as to define the probable contaminant flow paths into the Harbor and Lake.

### III. SOURCE AREAS AND POTENTIAL FOR CONTINUED RELEASE

The Report does not adequately address the issue of existing sources and the on-going release of site contaminants from those sources. Despite abundant evidence of waste residuals in the numerous trench logs and soil borings undertaken as part of the study, the Report essentially skirts the issue, concluding instead that neither vadose soils nor DNAPL product are the source of high contaminant concentrations in the deep portion of the aquifer (Sec. 9.1.1.6.6, pg. 215, para. 1 & 5). Examples of the issues left unaddressed follow.

#### Waste Deposits and Contaminated Soils

While the study data are not presented in a way that highlights the location of waste deposits, nevertheless, the information taken together overwhelmingly confirms the presence of extensive unabated contaminant sources throughout the site. For example, the Report identifies ground surface soil samples that are visibly contaminated (blue or black staining, clinkers and slag) and that manifest greatly elevated levels of chemical waste constituents (Sec. 9.1.1.6.3, pg. 213, para. 1). Vadose zone soil samples are reported to contain polynuclear aromatic hydrocarbons (PAH target compounds only) at levels as high as 7.6 percent by weight (Sec. 7.6.1.1, pg. 122, para. 5). Test trench logs from around the site are replete with references to oil, tar, creosote odors, and other

indications of waste deposits. Further, the Report concludes that in the surface soils, the highest concentration of inorganic contaminants occur in those samples which have the highest level of PAH. In the vadose soils, elevated levels of benzene are also correlated with the presence of PAH contaminants.

Except in the case of arsenic, the Report curiously skirts the issue of whether these unabated contaminant sources are still releasing waste constituents to the environment, focusing instead on the fact that they "are not the current source of high concentrations of (contaminants) in the deep portion of the sand aquifer" (Sec. 9.1.1.6.6, pg. 215, para. 2). With respect to arsenic, the Report seems to imply some sort of relationship between elevated levels in shallow groundwater (>100 ug/l), and the presence of that metal in saturated soil at concentrations greater than 10 mg/kg. It is not clear from the Report whether the soil is releasing arsenic to the groundwater or arsenic in the groundwater is sorbing onto the saturated soils.

The sampling data indicate that sources of continuing contaminant release exist at the site. Even rudimentary contouring analysis of the shallow groundwater quality data reveals that for at least three indicators -- general inorganic solutes (measured as specific conductance), ammonia, and arsenic -- leaching of source material in the vadose and shallow saturated soils is resulting in an on-going release of waste constituents. The existence of such source materials, and the release of contaminants from them, should be discussed in the Report and addressed in the remedy selection process. Furthermore, the locations of the sources should be more fully determined through use of geophysical investigation techniques. The data should then be plotted on site maps and cross sections, and compared with results of chemical testing.

### DNAPL

The Report concludes that "DNAPL (dense, non-aqueous phase liquid) is not a source of key site parameters" (Sec. 7.7.3, pg. 170, para. 2, and Sec. 9.1.1.6.6, pg. 215, para. 5). However, the Report does not adequately address the fact that gravity-driven migration of DNAPL clearly has occurred historically, and could be occurring now. The "golden-brown oil" described in soil boring SB-41 (Sec. 7.7.2.1.2, pg. 154, para. 2) is described as -- and must be -- DNAPL sorbed onto particles of sand/silt, because it was found at the base of the aquifer just above the confining clay zone. No other explanation satisfactorily accounts for its presence. No attempt was apparently made to chemically characterize this "golden-brown oil" or evaluate its source, and the Report seemingly dismisses its occurrence simply by suggesting that coal tar/creosote residues can only be "black and viscous" even though the location of this boring is proximate to the old coke ovens.

The fact that DNAPL flow has occurred, at least historically, is evidence that there is a potential for additional sources in the subsurface at and around the WCP site. One source is related to those areas within the unconfined aquifer where DNAPL has sorbed onto the sediments through which it passed. These areas provide potential for continued releases of contamination as groundwater flows through them. In addition, if a large enough volume of DNAPL has been released to the environment, it could be pooled at low points the surface of the clay till that are not yet delineated either under the WCP site, the public beach area or somewhere under Lake Michigan. This possibility strengthens the need to better characterize the clay till surface as described above under Heading II.

### Old Water Supply Well

The Report indicates that North Shore Coke and Chemical Company utilized two sources of process water for its plant operations, a 24-inch surface water intake into Waukegan Harbor and a groundwater well "located at the southwest corner of the boiler house" (Sec. 2.1.3.3, pg. 8, para. 3). This well was apparently completed in bedrock, having an overall depth of approximately 140 feet. No reference is made in the narrative of the history of the site as to the disposition of this production well. The old well should be located, assessed and, if necessary, sealed since it could be a conduit of contaminant migration into the bedrock aquifer.

### Geophysical Mapping

The WCP site has undergone substantial anthropogenic disturbance in the more than 130 years it has been used for industrial and commercial purposes. The nature and location of these disturbances are critically important in a remedial investigation, both from a source abatement perspective, as well as to understand the role the disturbances have played in contaminant migration. Many of the trench logs and soil borings reflect these disturbances, some of which appear to extend more than 25 feet below the ground surface (e.g., Appendix 4-A, Soil Boring Log SB-21). For a site of this size and complexity, the use of non-intrusive, geophysical techniques (borehole gamma and induction logging, electromagnetic and ground penetrating radar surveying) for subsurface mapping of source materials and transport pathways would appear to be essential. Such techniques are invaluable in delineating natural and unnatural zones for subsequent evaluation, determining lateral and vertical extent of sources such as "industrial pond deposits", verifying the presence or absence of potential buried metallic debris, delineating potential migration pathways such as former drain systems, locating subsurface structures such as the old production well, and validating contouring or other data analysis which was completed based on existing soil borings and sample results. Once such subsurface mapping has been done, subsequent intrusive forms of investigation can be focused in a systematic way to provide comprehensive information about contaminant sources, extent of contamination, and the probability for on-going release. This study is deficient since such geophysical techniques were not employed and the existing source areas were not thoroughly identified.

## IV. EXTENT OF CONTAMINATION

### Groundwater

The Report does not define the lateral and vertical extent of contamination in both subsurface sediments and groundwater. Wells installed along the west, east, and south sides of the WCP site demonstrate the presence of significant groundwater contamination, but the Report very simply states that this groundwater is influent into the surface water bodies of the Harbor and the Lake (see Sec. 2.2.5.2 and 8.4.1). The implication is that the contamination immediately becomes negligible upon entering the surface water; however, neither the specific

point(s) at which this contaminated groundwater enters the surface water, nor the characteristics of mixing in and between the two water bodies has been defined. In addition, the extent of groundwater contamination that is being transported to the south has not been determined.

The downward vertical gradients measured in the area of the groundwater divide are not surprising and, together with the measured horizontal gradients, indicate that groundwater travels both horizontally and vertically downwards and west to Waukegan Harbor, south to OMC property and the south part of the peninsula, and east to Lake Michigan. The Report should have outlined the various possibilities that exist with respect to groundwater migration into the surface water bodies, including:

- groundwater could flow with the sand aquifer for some distance before entering the surface water;
- the groundwater/surface water mixing zone could simply be limited to the near-shore environment, with only minimal mixing of very shallow groundwater, with deeper groundwater becoming stagnant at some point under the lake because of a lack of hydraulic gradient (at which point contaminant transport would be a function of density and concentration gradients);
- relatively dense contaminated groundwater could be migrating some distance out under Lake Michigan where it could then become fully influent to lake waters at some distal point where the sand aquifer pinches out and the clay till is exposed directly to the lake.

Additional sampling of groundwater and sediments should be conducted to determine the vertical and lateral extent of groundwater contamination and its emergence into the surface water bodies. Such sampling should probably be phased because the Lake Michigan surface water system is extremely large and geophysical surveying of the clay surface and computer simulations (see Heading II above) will be necessary in order to design sampling schemes in and under the surface water bodies. The groundwater interaction with Waukegan Harbor could probably be modeled for some contaminants using the existing data because the geometry of the Harbor is limited in size and adequate wells are already located along the Harbor wall on the WCP site. Such modeling will be complicated by the highly dynamic, bi-direction flow within the Harbor. Supplemental water level data and groundwater sampling may be needed to model transport and loading of key Harbor contaminants such as ammonia. Before any additional computer modeling can be performed for the Lake, however, additional groundwater monitoring wells are necessary, both along the beach right at the land surface/lake interface and over the southern part of the peninsula. Once the number and placement of needed additional wells has been determined, and the wells installed, it will be necessary to collect adequate hydraulic head data, including both point measurements and continuous measurements over various periods of time. These data would then be used as input to and allow for accurate calibration of the computer simulations. Following computer simulations, the additional sampling that is necessary to define vertical and lateral extent can be determined.

The Report associates the detection of benzene in MW-5S with OMC's above ground storage tanks (Sec. 7.7.1.2.1, pg. 139). This idea is mentioned in two other paragraphs in this Section, including the Summary. No benzene was detected in ground surface soil sample GS17, however, which appears to be positioned between the OMC above ground storage tanks and MW-5S. No other soil samples were collected in this area. Also, it appears that MW-5S is positioned upgradient from the OMC above ground storage tanks with respect to

groundwater flow, which would make this scenario unlikely. Since benzene is also associated with the coking waste on site, additional monitoring would be needed to characterize the origin of benzene detected at MW-5S.

### Sediments

The data show that contaminants at this site migrate as a function of both groundwater flow and density or gravity driven flow. It therefore is imperative to define the contaminant contribution to both subsurface sediments and surface water bodies in terms of lateral extent into both Lake Michigan and Waukegan Harbor. This concern could be addressed by sampling sediments at depth below the bottom of Lake Michigan and Waukegan Harbor in strategic locations as defined by existing Lake topographic data available in the literature, results of geophysical surveying related to spatial characteristics of subsurface stratigraphy, and computer modeling that shows the interactions between groundwater and surface water.

### Surface Water

The surface water sampling undertaken during the RI (Sec. 7.8.1) was inadequate to determine the effects of contaminant migration into both the Lake and the Harbor. The spatial distribution of the sampling locations in both water bodies was not sufficient to delineate the complex groundwater--to--surface water, and surface water--to--surface water exchange which exists at the site. The sampling locations chosen in Lake Michigan were not adequate to address the locations of groundwater entry into the Lake. While an attempt was made to vertically profile the water column in both the Lake and Harbor, the analytical method detection limits achieved for most parameters (e.g., cyanide, arsenic, ammonia) were inadequate to provide meaningful information which could be used to evaluate mixing characteristics and contaminant mass loading. For those parameters with adequate method detection limits (e.g. PAH), the single set of surface water data shows measurable impact to the waters of both the Harbor and near-shore Lake, though the Report makes no attempt to use these data to determine the significance of the bi-directional flow in the Harbor, or the nature and extent of surface water contaminant exchange between the Harbor and the Lake. Because only a single set of data was gathered, seasonal and weather--induced changes in surface water quality cannot be ascertained (Sec. 4.4). Ammonia data collected by OMC in conjunction with its NPDES permit indicate that significant water quality impacts have occurred in the Harbor water. These data, submitted to USEPA in August 1995, are attached hereto.

## V. CONTAMINANT MIGRATION AND IMPACT TO HARBOR AND LAKE

The Report does not adequately address the fate and transport of contaminants which have been, and continue to be, migrating from the site. Despite the fact that high levels of contamination are apparent in shallow and deep groundwater along the east, west and south boundaries of the site, the Report essentially concludes that the impact from these contaminants is insignificant due to the overall dilution potential of Lake Michigan.

### Migration Pathways

The Report concludes that groundwater transport is the only significant migration pathway for contaminants on the WCP site. DNAPL transport is discounted because free product was encountered only once at the basal till confining layer (see Heading III above). Atmospheric transport is discounted because surficial soils (upper six inches) are relatively free of compounds considered to be "susceptible to volatilization" (Sec. 8.2, pg. 189, para. 2). Organic vapor monitoring conducted during intrusive remedial investigation activities at the site reportedly showed "no detectable concentrations of organic compounds in air"; thus seemingly confirming this conclusion. No consideration, however, was given to wind borne transport of contaminated particulates, even though analytical results for most "background" soils samples revealed that they were contaminated with both organic and inorganic waste constituents characteristic of the WCP site -- especially polynuclear aromatic hydrocarbons and arsenic (Sec. 7.3, pg. 116, para. 1). Surface water transport was discounted because of the "absence of developed surface water drainage features", and "the site is very flat, promoting infiltration of precipitation" (Sec. 8.5.3, pg. 197, para 4). No consideration was given to the intrusion of surface water and shallow groundwater, contaminated through intimate contact with waste deposits, into storm drain structures and former water intake lines which traverse the WCP site and discharge into the Harbor and Lake. The locations of storm drains and sewers within the site are not fully identified nor evaluated in the Report nor are they shown on figures of site features. The Report simply -- and without support -- attributes the water quality in those discharges to the operations of Larsen Marine and OMC. In addition, there are numerous speculations throughout the Report to the role OMC may have played in spreading contaminants at the site, as a result of the demolition and grading undertaken after they purchased the property. In actuality, the grading work likely reduced -- not increased -- the potential for contaminant release by covering the highly contaminated source area process lagoons. Covering these lagoons reduced the potential for airborne transport, as well as diverted surface water away from them, thereby minimizing recharge to the groundwater through the contaminated lagoon sediments.

### Contaminant Transport Analysis for Groundwater

The groundwater contaminant transport analysis in the Report is inadequate because it greatly over-simplifies the behavior of the contaminants. The model considers five "key parameters", including benzene, phenol, arsenic, cyanide and ammonia (Sec. 8.0, pg. 186, para. 5). The transport factors that the model incorporates are flow velocity, dispersivity (longitudinal and transverse), retardation (sorption, ion exchange, etc.), and degradation (chemical and biological) (Appendix 8-B). The factors for retardation are calculated using literature values for the "organic carbon partition coefficient" of the solute, and estimates of the organic carbon content, bulk density and porosity of the soil/sediment horizon being evaluated (Table 8.4-1). A "model sensitivity analysis" was conducted to determine the factors most influential in the calculated rates of contaminant migration. The most influential factor for organic solutes was found to be degradation rate, while for inorganic solutes the most influential factor was flow velocity. No consideration was given to density-driven flow, which for the WCP site is likely to be significant.

The migration rates and contaminant distribution projected for organic contaminants at the WCP are likely to be understated, for the following reasons:

- benzene and phenol are almost certainly not the most mobile organic waste constituents (low molecular weight oxygenates such as acetone and similar ketones and aldehydes, which can be present at significant concentrations in coal pyrolysates, are much more mobile);
- there is little likelihood that the WCP organic waste constituents would be chemically or biochemically degraded in a groundwater regime which is outside the zone of active biological growth, has a relatively neutral pH, and is largely a reducing environment (i.e. of low Eh); and,
- the model does not consider colloidal transport, which for organic constituents of low aqueous solubility (e.g. PAH), may well be the most significant transport mechanism.

The migration rates projected for multivalent inorganic contaminants such as arsenic are probably in error as well, because the analysis does not address the complexity of their environmental occurrence and behavior. Not only do such contaminants exist in various oxidation states, but they exist in many different chemical forms. Each individual moiety has its own set of properties and transport characteristics. This complexity is exacerbated by the interconversion of one species to another, including organometallics, under conditions found in nature. This characteristic is well documented for arsenic, mercury and other "inorganic" contaminants. The Report alludes to this behavior (Sec. 6.2.2, pg. 107, para. 3), but then simply ignores it in the analysis of contaminant fate and transport.

#### Impact to Waukegan Harbor and Lake Michigan

The groundwater quality data clearly show substantial contaminant concentrations all along the site perimeter adjoining Waukegan Harbor and Lake Michigan, including the public beach. The groundwater fate and transport analysis shows that site contaminants have the potential to be transported to both the Harbor and the Lake. Topographic contours of the basal till suggest that density-driven, highest concentration contamination will flow out beneath the Lake and south below OMC Plant #1, to emerge at the point where this till horizon outcrops on the lake bottom. Logs of soil borings made along the public beach on Lake Michigan reveal sands with "boggy, coal tar and phenolic odors" right at, and just below, the water table. Mass loading calculations presented in Appendix 8A (Table 8.4-2) predict that, along with other site contaminants, more than 100 pounds of ammonia may be released each day to both the Harbor and the Lake.

The Report alludes to the fact that groundwater contamination which emerges into the Harbor may be mitigated by deposition into sediments, but then states those sediments are likely to be disturbed -- and presumably mobilized -- by commercial freighter traffic (Sec. 7.8.2, pg 178, para. 2) and mentions future plans for dredging (Sec. 2.2.4.2, pg. 20, para. 3). The Report acknowledges a dynamic, bi-directional circulation which hydraulically connects the harbor with the lake, and completely flushes the harbor every two to eight days. Despite the tremendous potential for dilution, the single set of surface water quality data collected during the study shows evidence of both inorganic and organic site contaminants in the Harbor, and outside the Harbor in

the Lake Michigan mixing zone. In spite of all this evidence, the Report does not address the issues of adverse environmental impacts and essential natural resources damage, and instead paradoxically concludes that "the WCP site groundwater does not impair the water quality of the open waters of Lake Michigan" (Sec. 8.5.3.3, pg. 204, para. 2).

## VI. RELEVANCE TO RISK ASSESSMENT AND SELECTION OF REMEDY

Unless uncertainties and deficiencies in the remedial investigation of the WCP site are resolved, they will propagate into the assessments of risk to human health and the environment. Beyond that, they will also propagate into the selection of a remedy most appropriate for mitigating those risks. Because of the nature, location, and substantial mass of the contaminants present on the site, there is significant potential risk associated with the WCP site. These contaminants have the ability to adversely effect not only human health, but the natural resources of the Great Lakes. The key uncertainties and deficiencies include:

- the nature and extent of contamination;
- the routes of human and environmental exposure to site contaminants;
- the vectors for release of site contaminants into the environment;
- the fate of site contaminants once they have been released into the environment;
- toxicological properties of "non-target" compounds;

OMC believes that these deficiencies must be addressed before the risk assessment for the WCP site is completed, and before the range of feasible remedial options is narrowed. OMC has a long term and strategic interest in the use and development of the WCP site. As property owner, OMC will insist on a carefully considered and conservatively implemented remedy to the site contamination, to insure that these interests are safeguarded.

**ATTACHMENT 1**

*OMC Technical Review Comments*

4TH DOCUMENT of Level 1 printed in FULL format.

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Information  
System (CERCLIS)

TAPE-DATE: March, 1995

EPA-ID: ILD980993570

VISTA-NO: 000173439

GM COKE PLT  
E 1/2MI NW1/4 SEC 22 T45N R12E  
WAUKEGAN, IL 60085

COUNTY: LAKE

COUNTY-CODE: 097

LATITUDE: 4221300

LONGITUDE: 08750000

EPA-REGION: 05

CONGRESS-DISTR: 10

FEDERAL-FACILITY: No

OWNERSHIP: Other

SMSA-CODE: 1600

NPL-STATUS: Is not currently nor was formerly on the proposed or final NPL.  
Includes unanticipated removals occurring at a location not previously identified  
as a Cerclis site.

USGS-HYDRO-LOC: 04040002

OPER-UNIT-INFO:

Operable Unit: SITE EVALUATION/DISPOSITION

Event: DISCOVERY

Lead: EPA, Fund Financed

Actual Compl. Date: 06/01/1984

Event: PRELIMINARY ASSESSMENT

Lead: State, Fund Financed

Actual Compl. Date: 12/18/1987

Action Priority Level: Lower

Event: SCREENING SITE INSPECTION



COPY

OUTBOARD MARINE CORPORATION

100 Sea-Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 708/689-6200

Direct Dial:847/689-6160  
Facsimile:847/689-6246

March 6, 1996

Sean Mulroney  
Assistant Regional Counsel (CS-3T)  
U.S. Environmental Protection Agency  
Region V  
77 West Jackson Boulevard  
Chicago, IL 60604-3590

**RE: Waukegan Manufactured Gas and Coke Plant Site/  
Waukegan Harbor Site - Site Identification**

Dear Sean:

Over the last several months, it has come to our attention that U.S. EPA has been identifying the Coke Plant site as an "operable unit" of the Waukegan Harbor NPL Site. This is incorrect. The area defined as the Coke Plant is not part of the Harbor Site. They are entirely separate and distinct sites with different boundaries, different contaminants, and different potentially responsible parties. It appears the Coke Plant may not be listed as a Superfund site at all.

On prior occasions, U.S. EPA has acknowledged that the two sites were overlapping but adjoining with different contaminants and that OMC entered into a Consent Decree only for the Harbor Site. The relationship of the two sites has not changed since the time these statements were made.

In addition, while I understand that the sites are supposed to be identified by different ID numbers, the CERCLIS ID number for the Coke Plant Site is the same as the ID number for the Waukegan Harbor Site. OMC requests U.S. EPA rectify this mistake and not identify the Coke Plant site as an operable unit or otherwise a portion of the Harbor Site and confirm the fact in writing. In

Sean Mulronev  
U.S. Environmental Protection  
Agency  
March 6, 1996  
Page 2

addition. please notify the IEPA and Corps of Engineers to inform them of this matter. If you have any questions, do not hesitate to call.

Sincerely yours,

A handwritten signature in cursive script that reads "Maribeth Flowers/kss".

Maribeth Flowers  
Senior Environmental Attorney

MF:kss  
Attachment

cc: Larry Schmitt, U.S. EPA  
D. Jeffrey Baddeley  
J. Roger Crawford  
Tricia Sutton

coke\opunt2.ltr

Sean Mulroney  
U.S. Environmental Protection  
Agency  
March 6, 1996  
Page 3

bcc: Kathleen T. Deveau  
John W. Watson  
Joseph S. Moran



OUTBOARD MARINE CORPORATION

100 Sea Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 847/689-6200

Mike E. Bellot  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 West Jackson Blvd.  
Chicago, Illinois 60604-3590

RE: OMC Waukegan Plant No. 1 Parking Lot Expansion.

Mr. Bellot,

In accordance with our recent discussions, we are transmitting information pertaining to our plans to construct a new asphalt parking lot on the north side of our Plant #1 facility. This new parking area, Figure 1, is urgently needed to accommodate 160 additional new hire or transfer personnel that will be occupying space within the Plant #1 facility. The new parking area is needed as soon as possible but no later than May 1, 1998.

Although OMC would have preferred to expand northward at a more easterly location, the planned location avoids to the maximum extent practicable contaminants derived from the former manufactured gas/coke plant operations. Although the Barr data indicates that soils within the designated area are all below action levels, significant additional soils sampling will be conducted prior to completing the design plans and commencing construction. The expanded parking area will also be segregated from the remainder of the MFG/Coke Plant site by fencing comparable to the existing fence along the northern side of the Plant #1 facility. Following grubbing of the designated area, only a minimal amount of soils grading will be required prior to placement of the parking lot base. Topographic information is contained on Figure 2.

The Barr data from the MFG/Coke Plant remedial investigation consists of six soil samples, three of which are within the designated parking lot expansion area (SS-13, GS-16, and SB-57) and two adjacent to the eastern (SB-44 and TT2201) and one adjacent to the western (SS-12) boundary of the expansion lot. Samples SS-13 and GS-16 were collected from 2 to 4 feet below ground surface (bgs) and 0.0 to 0.5 feet bgs respectively. Sample SB-57 was collected from 22.0 to 24.0 feet bgs and will not be considered due to the depth of the sample. Five soil samples were collected from SB-44, but only the 2 to 4 feet bgs interval will be considered. Sample TT2201 was collected from 3.5 feet bgs, while SS-12 was collected from 2.0 to 4.0 feet bgs. A review of the analytical data did not find any compounds in excess of Illinois Tier Approach to Cleanup Objectives (TACO) for Tier 1 construction worker scenario. Both a summary and a full compound list of the analytical results from the Remedial Investigation of the MFG/Coke Plant are provided in Attachment A. In addition, Attachment A contains a number of contaminant distribution maps from the MFG/Coke Plant Remedial Investigation.

March 6, 1998  
Mr. Mike Bellot  
Plant No. 1 Parking Lot Expansion  
Page 2

A total of 11 new soil samples will be collected at eight locations as shown on Figure 2. The selected sample locations will significantly expand the soils information within the designated parking lot area. The soil samples will be analyzed for inorganic, volatile organic, semivolatile organic, and phenolic compounds. Table 1 contains the parameter list that will be analyzed at each location, while Table 2 contains the sampling depths. This list is a modification of the Phase II soil analyte list developed during the MFG/Coke Plant Remedial Investigation. Samples will be collected from 0 to 2 feet bgs using a stainless steel hand auger and will be decontaminated between each location with alcanox wash. At two locations a second sample will be collected from 2 to 4 feet bgs in order to evaluate soil that might be encountered during the installation of fence posts. All samples will be placed in glass jars provided by the analytical laboratory and handled under standard chain of custody.

As indicated above, completion of the parking lot expansion area is urgent. As a result, OMC has located the expansion area in order to minimize any potential impact on the MFG/Coke Plant site. Based on the OMC accommodations, we firmly believe that the expansion can and should be completed on schedule.

We look forward to discussing this matter with you on Monday and will seek to resolve any questions you may have.

Sincerely,



Lisa A. Bongiovanni  
Environmental Control Analyst

#### Attachments

cc: M. Cannon  
R. Crawford  
T. Elsen  
J. Moran  
S. Mulroney  
M. Willis



C:\roads\KsF\PIIPARK.dwg { Fri Mar 06 15:59:49 1998

○ Proposed surface  
subsurface soil sa  
locations (1 to 2  
below ground surf  
bgs) & (2 to 4ft.

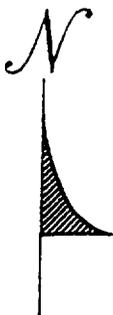
△ Proposed surface  
sample locations  
(1 to 2 ft. bgs)

□ Existing soil samplin  
locations

Sample locations are  
approximate

PROPOSED PARKING LOT

OUTBOARD MARINE CO  
Proposed Parking Lot  
Waukegan Plant No.  
Waukegan, Illinois



1 inch = 50 ft.

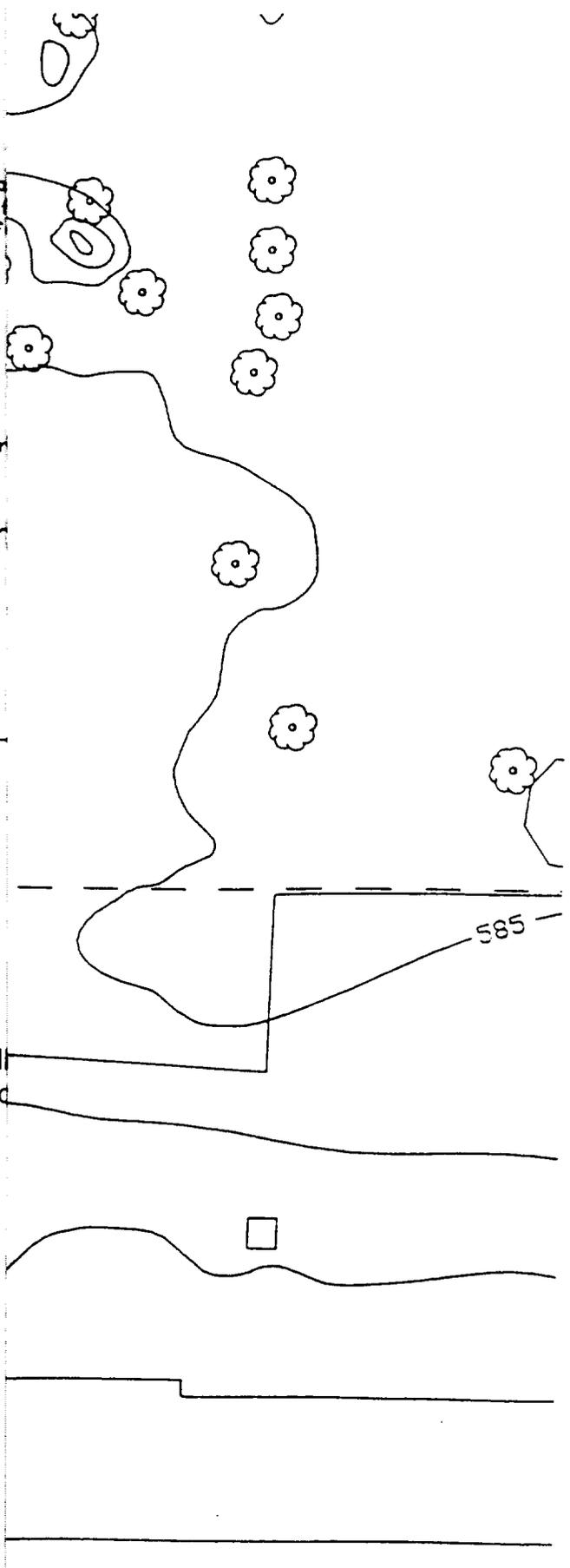


Table 1  
 Parameter List (1)  
 For Parking Lot Expansion  
 Waukegan Plant No. 1  
 Waukegan Illinois

Inorganic Compounds	Volatile Organic Compounds	Semivolatile Organic Compounds		Phenolic Compounds
Arsenic (total) Cadmium Cyanide (total) Lead Mercury Selenium	Benzene Ethyl benzene Toluene Total Xylenes	Acenaphthene Acenaphthylene Anthracene Benzo (a) anthracene Benzo (a) pyrene Benzo (b) fluoranthene Benzo (ghi) perylene Benzo (k) fluoranthene Carbazole Chrysene	Dibenzo (ah) anthracene Dibenzofuran Fluoranthene Fluorene Indeno (1,2,3-cd) pyrene 2-Methylnaphthalene Naphthalene Phenathrene Pyrene	o-Cresol p-Cresol 2,4-Dimethylphenol Phenol

1) Parameter list is based on Phase II soil analyte list, Coke Plant Remedial Investigation

Table 2  
 Sample Collection Key  
 Parking Lot Expansion  
 Waukegan Plant No. 1  
 Waukegan, Illinois

Location	Depth ft (bgs)	Inorganic	VOCs	SVOCs	Phenolic Compounds
B-OMC-1	0 - 2 & 2 - 4	X	X	X	X
B-OMC-2	0 - 2 & 2 - 4	X	X	X	X
B-OMC-3	0 - 2	X	X	X	X
B-OMC-4	0 - 2	X	X	X	X
B-OMC-5	0 - 2	X	X	X	X
B-OMC-6	0 - 2	X	X	X	X
B-OMC-7	0 - 2	X	X	X	X
B-OMC-8	0 - 2	X	X	X	X

ATTACHMENT A

TABLE 7.1-1 (Cont.)

SUMMARY OF FIELD SCREENING RESULTS AND LABORATORY ANALYTICAL RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	FIELD ANALYSIS <sup>1</sup>				LABORATORY ANALYSIS <sup>1</sup> (Concentrations in ug/kg)											
		NONMETHANE HEADSPACE (PPM)	OIL SHEEN	CODOR	pH	PAHS		PHENOL	TOTAL PHENOLS	BENZENE	BTX	ARSENIC	CYANIDE	CADMIUM	LEAD	MERCURY	SELENIUM
						TOTAL	CARC.										
GS13	0-0.5	0	N	N	7.8	9.302 a	3.203 a	.11 J	.37 a	.0011 U	ND	4.1 J	.51 U	.62 U	10.9	.02 U	55 U
GS14	0-0.5	0	N	M	7.8	3.458 a	1.159 a	.045 U	ND	.001 U	ND	4.2 J	.1 U	.6 U	4.2	.02 U	43 U
GS15	0-0.5	2.6	N	M	7.6	3592 a	2188 a	.49 U	ND	.0002 J	.001 a	20.2 J	4.5	.66 U	49.9	.73	1.3 J
GS16	0-0.5	0	N	N	7.5	20.06 a	8.39 a	.10 U	ND	.0003 J	.0014 a	5.2 J	.2 U	.69 U	19.2	.02 U	1.3 J
GS17	0-0.5	0	N	N	8.2	14.068 a	7.57 a	.048 U	ND	.0011 U	ND	6.2 J	.53 U	.65 U	17.6	.04 U	57 U
MW30	26.0-28.0	160	N	L	--	ND	ND	71	105 a	.012 U	.004 a	--	--	--	--	--	--
P107	11.5-13.5	400	N	S	8.7	ND	ND	28	47.7 a	.058	.0985 a	10.1 J	0.35 B	0.67 U	2.6	0.02 U	0.45 B
PW01	14.5-14.5	180	N	L	7.8	1.154 a	ND	.051 U	ND	.0027	.0059 a	161	.18 B	.69 U	3 J	.02 U	7.1
PW01	27.0-29.0	130	T	S	8.4	ND	ND	50	76 a	.065	.083 a	250	.97 B	.73 U	3 J	.03 U	2
S804	30.0-32.0	1250	N	M	--	ND	ND	35	80.9 a	.019	.022 a	--	--	--	--	--	--
S804	22.5-24.5	150	N	M	--	3.45 a	ND	37 J	68.6 a	.11	.18	--	--	--	--	--	--
S807	2.0-4.0	0	N	M	8.2	.177 a	ND	.057 U	.164 a	.0015 J	.0019 a	54.9 J	.37 B	1 B	17.7 J	.45	65 B
S807	7.0-9.0	5	N	M	8	1.039 a	.173 a	.051 U	ND	.0012 U	.0003 a	37.4 J	.45 B	.78 U	9.3 J	.16	1.3 B
S807	17.0-19.0	70	N	L	8.3	4.9	ND	.052 U	ND	.0014	.0084 a	9.2 J	.61 B	.76 B	3.3 J	.69 U	87 B
S807	24.5-26.5	200	N	M	8.4	5.6 a	ND	200	297 a	.0029	.0188	7.8 J	.65 B	.68 B	4.5 J	.09 U	8 B
S807	29.5-31.5	70	N	S	8.3	6.1 a	ND	210	309 a	.0014	.0108	14.9 J	.74 B	.74 U	5.4 J	.07 U	71 B
S808	14.5-16.5	2	N	N	9	ND	ND	.052 U	ND	.0003 J	.0003 a	1.9 B	.12 U	.68 U	4.6	.07 U	59 U
S808	22.0-24.0	1440	N	N	8.5	ND	ND	.052 U	ND	.0059	.0059	1.8 B	1.1 B	.72 U	3.1	.68 U	51 U
S808	27.0-29.0	1000	N	M	8.5	ND	ND	100	189.6	.43	.58	39.3 J	.87 B	.74 U	4.9	.1 U	55 a
S809	4.5-6.5	23	N	N	4.2	9.927 a	.062 a	.051 U	ND	.0003 J	.0006 a	761 J	2.6	.69 U	20.1	1.3	52 a
S809	19.5-21.5	74	N	L	8.1	.3 a	ND	39	61.2 a	.0003 J	.0063 a	50.4 J	3.4	1.1 B	4.3	.69 U	1.7
S809	27.0-29.0	33	N	M	8.2	.133 a	ND	21	41.3	.0018	.0038 a	58.7 J	2.7	.71 U	3.4	.68 U	97 a

TABLE 7.1-1 (Cont.)

SUMMARY OF FIELD SCREENING RESULTS AND LABORATORY ANALYTICAL RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	FIELD ANALYSIS <sup>1</sup>				LABORATORY ANALYSIS <sup>1</sup> (Concentrations in µg/kg)											
		NONMETHANE HEADSPACE (PPM)	OIL SHEEN	ODOR	pH	PANS		PHENOL	TOTAL PHENOLS	BENZENE	BTEX	ARSENIC	CYANIDE	CADMIUM	LEAD	MERCURY	SELENIUM
						TOTAL	CARC.										
SB42	2.0-4.0	0	T	N	10	.646 a	.32 a	.049 U	ND	.0003 J	.0011 a	56.2	23.9	1.6	23.5	.16	35 U
SB42	7.0-9.0	0	M	L	9.5	.36 a	ND	.059 J	.059 a	.0013	.0013	6.5	2.5	.72 U	2.9	.02 U	37 U
SB42	17.0-19.0	7	T	L	9.1	.391 a	.064 a	.051 U	ND	.0015	.0019 a	6	.26 B	.69 U	2.2	.02 U	36 U
SB42	27.0-29.0	100	M	M	8.5	ND	ND	59	92.1	.0032	.0121	26.7	.7 B	.89 B J	3.4	.02 U	38 U
SB43	2.0-4.0	0	M	M	8.5	2.471 a	1.402 a	.052 U	ND	.0012 U	ND	1.1 B	.12 U	.69 U	2.8 J	.11	49 U
SB43	7.0-9.0	1	M	L	8.4	ND	ND	.052 U	ND	.0012 U	ND	6	.12 U	.7 U	1.6 J	.11 U	5 U
SB43	17.0-19.0	3	T	L	9.3	ND	ND	.05 U	ND	.0013	.0026 a	5.2	.12 U	.7 U	1.8 J	.07 U	5 U
SB43	27.0-29.0	60	M	L	8.9	ND	ND	43	69 a	.047	.0476 a	23.4	.63 U	.72 U	2.6 J	.08 U	52 U
SB44	2.0-4.0	2	T	L	6.8	1.761 a	.473 a	.075 J	.123 a	.0012 J	.0242 a	5.5 J	.27 U	.69 U	16.3 J	.02 U	65 B J
SB44	7.0-9.0	1	M	L	6.8	1.538 a	.14 a	.05 U	ND	.0012 U	.0016 a	5 J	.36 U	.73 U	2.2 J	.02 U	52 U J
SB44	17.0-19.0	200	M	L	9	4	ND	.099 U	.14 a	.0012 U	.0053 a	10.3 J	1.1 U	.69 U	2.5 J	.02 U	49 U J
SB44	22.0-24.0	950	T	M	9	--	--	--	--	.0006 J	.0165 a	--	--	--	--	--	--
SB44	27.0-29.0	150	M	M	9.1	ND	ND	41	92	.008	.0153 a	56.8 J	1.6 U	.73 U	3.9 J	.02 U	52 U J
SB45	2.0-4.0	--	--	L	--	621.3 a	301.5 a	2.9 U	ND	.0028 J	.0061 a	15.7	19.7	.82 U	41.1	.54	5.8 J
SB45	7.0-9.0	25	T	M	7.7	1.74 a	.211 a	.12 J	.19 a	.0006 J	.0017 a	3.6	.12 U	.72 U	2.9	.02 U	37 U
SB45	17.0-19.0	1150	M	--	8.7	105.08 a	47.47 a	30	51.1	.31	1.018 a	4.8	.12 U	1 B	2.8	.02 U	4.8 J
SB45	29.5-31.5	40	M	M	9	1.2 a	ND	15	33.4	.011	.0179 a	38.8	1.4 B	.72 U	3.6	.02 U	1.9 J
SB46	9.5-11.5	160	L	M	8.2	1.156 a	.19 a	.13 J	.183 a	.0011 U	ND	2.8	.2 B J	.7 U	2.3	.69 U	35 U J
SB46	17.0-19.0	640	M	L	8.5	.15 a	ND	4.5	11.7	.001 J	.02 a	5.2	.54 B J	.73 U	9.4	.02 U	38 U J
SB46	29.5-31.5	--	M	S	8.9	ND	ND	100	166 a	.029	.155	41.7	1.1 B J	.71 U	3.1	.02 U	37 U J

TABLE 7.1-1 (Cont.)

SUMMARY OF FIELD SCREENING RESULTS AND LABORATORY ANALYTICAL RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	FIELD ANALYSIS <sup>1</sup>				LABORATORY ANALYSIS <sup>1</sup> (Concentrations in µg/kg)											
		NONHEXANE HEADSPACE (PPM)	OIL SHEEN	ODOR	pH	PAHs		PHENOL	TOTAL PHENOLS	BENZENE	BTEX	ARSENIC	CYANIDE	CADMIUM	LEAD	MERCURY	SILICUM
						TOTAL	CARC.										
S852	9.5-11.5	1	N	N	7.8	ND	ND	.052 U	ND	.0012 U	ND	1.7 B	.12 U	.73 U	2.8 J	.08 U	52 U
S852	17.0-19.0	8	N	L	8.5	.318 a	ND	.052 U	ND	.0012 U	ND	3.8	.12 U	1.7	6 J	1 U	52 U
S852	32.0-34.0	10	N	N	8.3	ND	ND	.054 J	.214 a	.0012 U	ND	17.7	.46 B	.72 U	3 J	.08 U	74 a
S853	7.0-9.0	0	N	N	7.5	ND	ND	.051 U	ND	.0012 U	ND	2.8 J	.12 U	.79 B	2.9 J	.04 U	51 U
S853	27.0-29.0	7	N	L	9.2	ND	ND	.054 U	ND	.0012 U	ND	1.7 BJ	4.1	.73 U	2.9 J	.04 U	52 U
S855	2.0-4.0	17	N	S	7.9	19764 a	7310 a	2.6 U	ND	.058 J	9.358 a	11	.93 BJ	1 B	46.6	.04 U	2 J
S856	27.0-29.0	65	T	S	8.6	ND	ND	180	279 a	.27	.722	56.2	3 J	.7 U	3.2	.02 U	50 U
S857	22.0-24.0	7	N	N	8.3	ND	ND	.24 J	3.19 a	.018	.0739	8	.28 BJ	.71 U	3	.02 U	37 U
S859	2.0-4.0	5	N	N	8.3	.167 a	ND	.051 U	ND	.0007 J	.0018 a	1.2 B	.13 U	.8 U	8.8 J	.03 U	68 B
S859	7.0-9.0	35	N	L	8.5	.064 a	ND	.049 U	ND	.0044	.0047 a	2.7	0.12 U	0.78 U	3.0 J	0.03 U	37 U
S859	17.0-19.0	300	N	S	8.9	ND	ND	.049 U	ND	.0003 J	.0006 a	3.1	.61 U	.77 U	4.1 J	.02 U	53 B
S859	27.0-29.0	100	N	S	8.9	ND	ND	.051 U	.16 a	.061	.0514 a	2.2 B	.61 U	.77 U	5.1 J	.03 U	37 U
S860	2.0-4.0	--	N	N	8.1	5.29 a	3.56 a	.59 U	ND	.6014 U	ND	33.6	.12 U	1.3	11.5 J	.04 U	54 a
S860	7.0-9.0	220	N	L	7.8	5.27 a	.25 a	.1 U	ND	.0004 J	.0183 a	63	20.2	.9 U	6.1 J	1.1 J	12 J
S860	17.0-19.0	20	N-M	L	8.5	4.6	ND	.071 J	.306 a	.0005 J	.0016 a	11.5	.29 B	.78 U	3.1 J	.03 U	67 a
S860	27.0-29.0	5	N	S	8.8	5.5 a	ND	150	221 a	.0075	.0169	8.8	.61 U	.78 U	4 J	.03 U	63 a
SC01	2.0-4.0	1.5	N	N	--	.043 a	ND	.41 U	ND	.012 U	ND	6.1 JJ	--	.73 U	3	.07 U	52 U
SC02	2.0-4.0	0	N	N	--	12.087 a	4.75 a	.44 U	ND	.015 U	.002 a	61.6 J	--	.83 U	8.1	.09 U	50 U
SS01	2.0-4.0	4	T	N	--	.169 a	.04 a	.38 U	ND	.012 U	ND	7.2	--	.68 U	11.7 J	.05 U	57 a
SS02	2.0-4.0	0.5	N	N	--	1.813 a	.801 a	.39 U	ND	.012 U	.005 a	.91 U	--	.72 U	3 J	.08 U	51 U
SS03	2.0-4.0	42	N	N	--	5.03 a	1.073 a	.43 U	ND	.001 J	.001 a	5.6	--	.79 U	15.6 J	.09 U	54 a
SS04	2.0-4.0	8	N	N	--	3.215 a	1.21 a	.39 U	ND	.013 U	.005 a	2.6	--	.7 U	8 J	.07 U	51 U
SS05	2.0-4.0	150	N	N	--	25.18 a	9.32 a	.4 U	ND	.012 U	ND	3.7	--	.7 U	9.7 J	.07 U	51 U

TABLE 7.1-1 (Cont.)

## SUMMARY OF FIELD SCREENING RESULTS AND LABORATORY ANALYTICAL RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	FIELD ANALYSIS <sup>1</sup>				LABORATORY ANALYSIS <sup>1</sup> (Concentrations in µg/kg)											
		NONHEXANE HEADSPACE (PPM)	OIL SHEEN	ODOR	pH	PAMS		PHENOL	TOTAL PHENOLS	BENZENE	BTEX	ARSENIC	CYANIDE	CAESIUM	LEAD	MERCURY	SELENIUM
						TOTAL	CARC.										
SS06	2.0-4.0	11	M	N	--	.966 a	.366 a	.4 U	ND	.013 U	ND	5.5	--	.82 BJ	9.7 J	.09 U	.65 UJ
SS07	2.0-4.0	0	F	L	--	10.956 a	.136 a	.39 U	ND	.012 U	.014 a	4.2	--	1.9 J	10.8 J	.07 U	.54 BJ
SS08	2.0-4.0	2	F	N	--	67.07 a	23.66 a	.14	27.21 a	.017 U	ND	91.5	--	1.2 BJ	18.6 J	.11 U	12.5 J
SS09	2.0-4.0	0	M	N	--	ND	ND	.41 U	ND	.012 U	ND	8.7	--	.72 UJ	12.2 J	.08 U	.55 UJ
SS10	2.0-4.0	2	F	N	--	2.5 a	1.49 a	.39 U	ND	.012 U	ND	6.3	--	.69 UJ	17.8	.03 U	.84 UJ
SS11	2.0-4.0	0	M	N	--	1.762 a	.906 a	.37 U	ND	.011 U	ND	1.4 B	--	.67 UJ	3.8 J	.08 U	.44 UJ
SS12	2.0-4.0	0	M	N	--	ND	ND	.4 U	ND	.012 U	ND	1.3 B	--	.72 UJ	3.8 J	.09 U	.34 UJ
SS13	2.0-4.0	6	M	N	--	.772 a	.382 a	.38 U	ND	.011 U	ND	1.5 B	--	.75 BJ	3.1 J	.08 U	.48 UJ
SS14	2.0-4.0	6	F	N	--	668.8 a	154.3 a	1.2 J	2.4 a	.035	.094 a	4.4	--	.82 UJ	5.1 J	.09	2.2 J
SS15	2.0-4.0	0	N	N	--	5.565 a	3.315 a	.063 J	.063 a	.012 U	.002 a	3.6 UJ	--	1 U	3.8	.11 U	.45 U
SS16	2.0-4.0	0.5	M	N	--	.961 a	.272 a	.4 U	ND	.012 U	ND	10.8 J	--	1.3 B	10.5	.18	.57 B
SS17	2.0-4.0	1	M	N	--	42.65 a	17.15 a	.062 J	.062 a	.011 U	.001 a	1.1 UJ	--	.65 U	4.7	.07 U	.29 U
1103W01	4	99	M	S	--	4326 a	67 a	490 UJ	ND	18 J	108.5 a	236	956	--	--	--	--
1103W02	3.5	630	M	S	--	5013 a	669 a	41 J	173 a	62 J	477 a	20.6	--	.68 UJ	40.7 J	.68	3.8 J
1105E01	5	0	M	N	--	16.154 a	8.491 a	--	--	.012 U	.003 a	--	--	--	--	--	--
1106A01	5	7	M	U	--	--	--	--	--	.003 J	.023 a	304	52.4 J	--	--	--	--
110102	4	23	M	N	--	2794.5 a	134.5 a	.31 U	ND	1.5 UJ	10.14 a	--	--	--	--	--	--
110204	2.5	90	M	L	--	--	--	--	--	.013 U	ND	--	--	--	--	--	--
110206	2.5	--	--	--	--	105.89 a	59 a	.29 J	1 a	--	--	--	--	--	--	--	--
110209	1	--	--	--	--	11.42 a	7.31 a	.36 U	ND	--	--	--	--	--	--	--	--
110301	4	22	M	S	--	1005 a	12 a	--	--	.43	7.93	360	8 J	--	--	--	--
110302	4	5	F	L	--	906 a	252 a	.26	64.8 a	.54 J	8.49 a	--	--	--	--	--	--

TABLE 7.1-1 (Cont.)

SUMMARY OF FIELD SCREENING RESULTS AND LABORATORY ANALYTICAL RESULTS

SAMPLE LOCATION	SAMPLE DEPTH (FT)	FIELD ANALYSIS <sup>1</sup>				LABORATORY ANALYSIS <sup>1</sup> (Concentrations in ng/kg)											
		NONMETHANE HEADSPACE (PPH)	OIL SHEEN	ODOR	PH	PAHs		PHENOL	TOTAL PHENOLS	BENZENE	BTEX	ARSENIC	CYANIDE	CADMIUM	LEAD	MERCURY	SELENIUM
						TOTAL	CARC.										
110303	4	1	N	N	--	.087 a	.044 a			.013 U	.002 a	--	--	--	--	--	--
110403	6	--	--	--	--	8.872 a	4.718 a	.41 U	.5 a	--	--	--	--	--	--	--	--
110602	4.5	9	N	S	--	1006.9 a	28.9 a	38 U	ND	.06 U	.175 a	.92 B	--	.67 U	1.8 J	.08 U	3 B
110604	2.5	0.5	N	N	--	8.956 a	4.09 a	.37 U	ND	.011 U	ND	6.5	--	.68 U	11.5 J	.09 U	1.9
110701	4.5	38	N	N	--	--	--	--	--	--	--	1820	13.7 J	1.6 J	19 J	5.6	1.5 UJ
110703	4.5	150	N	P	--	2115 a	22 a	210 U	ND	1.4 U	13.66 a	--	--	--	--	--	--
110802	4	40	N	S	--	603.7 a	19.8 a	60 U	ND	.018 J	1.91 a	--	--	--	--	--	--
110902	6	9	N	N	--	.338 a	.089 a	--	--	.012 U	.003 a	--	--	--	--	--	--
111001	7	3440	N	N	--	918 a	ND	120 U	ND	31	183.9	318	2.5 BJ	--	--	--	--
111201	4	1700	N	S	--	992 a	ND	130 U	ND	.6	98.68	--	--	--	--	--	--
111301	4.5	0	N	N	--	ND	ND	--	--	.011 U	.012 a	--	--	--	--	--	--
111402	4	800	N	S	--	71.06 a	6.4 a	1.6 U	ND	1 J	12.135 a	38	28.5 J	4.4 J	15.3 J	.24	4.2 J
111501	5.5	750	N	S	--	3.243 a	.04 a	--	--	.001 J	.009 a	--	--	--	--	--	--
111602	4.5	3.5	N	L	--	2.091 a	.779 a	--	--	.011 U	ND	--	--	--	--	--	--
111701	4.5	38	N	N	--	.042 a	ND	.4 U	ND	.011 U	ND	--	--	--	--	--	--
111901	4.5	2000	N	S	--	583.3 a	109.7 a	--	--	.75	2.824 a	--	--	--	--	--	--
112101	4.5	0	N	N	--	12.345 a	5.95 a	--	--	.012 U	ND	--	--	--	--	--	--
112201	3.5	0.5	N	N	--	--	--	--	--	.014 U	ND	--	--	--	--	--	--
112303	4	8015	N	P	--	--	--	--	--	22	596	--	--	--	--	--	--
112502	2	3	N	S	7.2	174 a	57.4 a	2 J	4.2 a	.003	.0049 a	115 J	27.3 J	.71 U	454 J	8	2 J
112503	3	57	N	L	3.8	62.7 a	2.2 a	.86 U	ND	.015 J	.166 a	1720 J	1390 J	2.3	14.2	5	5.8 J

TABLE 4.1-16 (cont.)

SOIL QUALITY DATA  
TEST TRENCH SAMPLES  
VOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	TT2201		TT2301	TT2502	TT2501	
	3.5'		4'	2'	3'	
	03/12/92	03/12/92	03/19/92	10/06/93	10/06/93	10/08/93
	Sample	Duplicate		Sample	Duplicate	
<b>BETX COMPOUNDS</b>						
Benzene	14 U	14 U	22000	1.4	3.0	15 J
Ethyl Benzene	14 U	14 U	64000	1.2 U	1.2 U	4 J
Toluene	14 U	14 U	140000	0.5 J	1.0 J	27
Xylenes	14 U	14 U	370000	--	--	120
m & p Xylene	--	--	--	0.3 J	0.6 J	--
o-Xylene	--	--	--	1.2 U	0.3 J	--
Sum of BETX	ND	ND	596000	2.2 a	4.9 a	166 a
<b>CHLORINATED COMPOUNDS</b>						
Bromodichloromethane	14 U	14 U	2900 U	--	--	20 U
Carbon Tetrachloride	14 U	14 U	2900 U	--	--	20 U
Chloroethane	14 U	14 U	2900 U	--	--	20 U
Chloroform	14 U	14 U	2900 U	--	--	20 U
Chloromethane	14 U	14 U	2900 U	--	--	20 U
Chlorobenzene	14 U	14 U	2900 U	--	--	20 U
Chlorodibromomethane	14 U	14 U	2900 U	--	--	20 U
1,1-Dichloroethane	14 U	14 U	2900 U	--	--	20 U
1,2-Dichloroethane	14 U	14 U	2900 U	--	--	20 U
1,1-Dichloroethylene	14 U	14 U	2900 U	--	--	20 U
1,2-Dichloroethylene	14 U	14 U	2900 U	--	--	20 U
1,2-Dichloropropane	14 U	14 U	2900 U	--	--	20 U
Cis-1,3-Dichloro-1-propene	14 U	14 U	2900 U	--	--	20 U
Trans-1,3-Dichloro-1-propene	14 U	14 U	2900 U	--	--	20 U
Methylene Chloride	42	81	2900 U	--	--	20
Styrene	14 U	14 U	2900 U	--	--	20 U
1,1,2,2-Tetrachloroethane	14 U	14 U	2900 U	--	--	20 U
Tetrachloroethylene	14 U	14 U	2900 U	--	--	20 U
1,1,1-Trichloroethane	14 U	6 J	2900 U	--	--	20 U
1,1,2-Trichloroethane	14 U	14 U	2900 U	--	--	20 U
Trichloroethylene	14 U	14 U	2900 U	--	--	20 U
Vinyl Chloride	14 U	14 U	2900 U	--	--	20 U
<b>OTHER COMPOUNDS</b>						
Acetone	42 U	98	2900 U	--	--	20 U
Bromoform	14 U	14 U	2900 U	--	--	20 U
Bromomethane	14 U	14 U	2900 U	--	--	20 U
Carbonylsulfide	6 J	10 J	480 J	--	--	12 J
2-Hexanone	14 U	14 U	2900 U	--	--	20 U
Methyl Ethyl Ketone	21	42	2900 U	--	--	20 U
Methyl Isobutyl Ketone	14 U	14 U	2900 U	--	--	20 U

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected. Note that the laboratory would have reported, with a J qualifier, any detected concentration below the stated quantitation limit but above the laboratory's method detection limit. The laboratory's method detection limit is typically about 10 percent of the stated quantitation limit in the table.

J..006  
01/24/94

TABLE 4.1-7 (cont.)

SOIL QUALITY DATA  
SURFICIAL SOIL SAMPLES  
INORGANIC COMPOUNDS

(concentrations in mg/kg)

	SS04	SS07	SS09	SS09	SS10	SS11	SS12	SS13
	-----	-----	-----	-----	-----	-----	-----	-----
	01/11/92	01/13/92	01/11/92	01/11/92	01/11/92	01/11/92	01/11/92	01/12/92
Arsenic, total	5.5	4.2	91.5	8.7	6.3	1.4 B	1.3 B	1.5 B
Cyanide, total	--	--	--	--	--	--	--	--
Aluminum	4050	6120	3490	12500	1720	1100	913	919
Antimony	2.7 R	2.6 R	3.5 R	2.7 R	2.8 BJ	2.5 R	2.7 R	3.2 BJ
Barium	39.1 B	23.3 BJ	56.7 B	105	36.3 B	5.8 B	4.6 B	4.9 B
Beryllium	0.37 U	0.39 B	0.66 B	0.61 B	0.33 B	0.04 U	0.07 U	0.10 U
Calcium	0.82 BJ	1.9 J	1.2 BJ	0.72 UJ	0.69 UJ	0.67 UJ	0.72 UJ	0.75 BJ
Calcium	17000	13700	3430	10900	28100	25500	25000	24700
Chromium, total	9.0	12.2	6.1	18.6	7.7	5.0	3.2	3.6
Cobalt	5.3 B	6.9 B	2.6 B	10.9 B	4.0 B	1.1 B	3.7 B	1.3 B
Copper	11.6	19.7	18.9	24.1	12.5	10.5	7.7	4.3 U
Iron	9580	13300	4930	21200	9210	2970	2780	2790
Lead	9.7 J	10.8 J	18.6 J	12.2 J	17.8	3.8 J	3.8 J	3.1 J
Magnesium	9670	8640	1400 B	7880	15700	13200	12300	12800
Manganese	214 J	399 J	52.0 J	973 J	190 J	121 J	157 J	137 J
Mercury	0.09 U	0.07 U	0.11 U	0.08 U	0.08 U	0.08 U	0.07 U	0.08 U
Nickel	8.0 B	17.0	6.5 U	21.0	8.3 B	5.1 U	4.9 U	4.2 U
Potassium	397 B	684 B	261 B	1180 B	374 B	162 U	173 U	155 U
Selenium	0.65 UJ	0.54 BJ	12.5 J	0.55 UJ	0.84 UJ	0.44 UJ	0.34 UJ	0.48 UJ
Silver	0.43 U	0.41 U	0.56 U	0.45 U	0.40 U	0.39 U	0.42 U	0.40 U
Sodium	271 U	239 B	382 U	274 U	241 U	295 U	233 U	294 U
Thallium	2.1 U	0.40 U	2.7 U	2.0 U	1.9 U	1.9 U	2.0 U	1.9 U
Vanadium	14.3	17.7	5.1 B	29.9	11.5 B	6.3 B	4.5 B	4.7 B
Zinc	58.0	62.4	29.8	65.4	50.1	33.0	32.3	17.7

-----  
-- Not analyzed.

B The reported value is less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

R Associated value is unusable.

U Not detected.

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01/24/94

TABLE 4.1-8 (cont.)

SOIL QUALITY DATA  
SURFICIAL SOIL SAMPLES  
VOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SS06	SS07	SS08	SS09	SS10	SS11	SS12	SS13
	03/11/92	03/13/92	03/11/92	03/11/92	03/11/92	03/11/92	03/11/92	03/12/92
<b>BETX COMPOUNDS</b>								
Benzene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Ethyl Benzene	13 U	1 J	17 U	12 U	12 U	11 U	12 U	11 U
Toluene	13 U	1 J	17 U	12 U	12 U	11 U	12 U	11 U
Xylenes	13 U	13 J	17 U	12 U	12 U	11 U	12 U	11 U
Sum of BETX	ND	14 a	ND	ND	ND	ND	ND	ND
<b>CHLORINATED COMPOUNDS</b>								
Bromodichloromethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Carbon Tetrachloride	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Chloroethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Chloroform	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Chloromethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Chlorobenzene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Chlorodibromomethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,1-Dichloroethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,2-Dichloroethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,1-Dichloroethylene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,2-Dichloroethylene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,2-Dichloropropane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Cis-1,3-Dichloro-1-propene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Trans-1,3-Dichloro-1-propene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Methylene Chloride	20 U	18 U	71 U	22 U	12 U	11 U	17 U	12 U
Styrene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,1,2,2-Tetrachloroethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Tetrachloroethylene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,1,1-Trichloroethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
1,1,2-Trichloroethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Trichloroethylene	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Vinyl Chloride	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
<b>OTHER COMPOUNDS</b>								
Acetone	17 U	11 U	21 U	12 U	12 U	16 U	20 U	25 U
Bromoform	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Bromomethane	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Carbonylsulfide	13 U	12 U	4 J	12 U	12 U	11 U	12 U	11 U
2-Hexanone	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U
Methyl Ethyl Ketone	13 U	12 J	13 J	12 U	12 U	9 J	12 U	10 J
Methyl Isobutyl Ketone	13 U	12 U	17 U	12 U	12 U	11 U	12 U	11 U

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected. Note that the laboratory would have reported, with a J qualifier, any detected concentration below the stated quantitation limit but above the laboratory's method detection limit. The laboratory's method detection limit is typically about 10 percent of the stated quantitation limit in the table.

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01/24/94

TABLE 4.1-9 (cont.)

SOIL QUALITY DATA  
SURFICIAL SOIL SAMPLES  
SEMIVOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SS06	SS07	SS08	SS09	SS10	SS11	SS12	SS13
	03/11/92	03/10/92	03/11/92	03/11/92	03/11/92	03/11/92	03/11/92	03/11/92
<b>CARCINOGENIC COMPOUNDS</b>								
Benzo(a)anthracene	58 J	390 U	4600	410 U	240 J	120 J	400 U	60 J
Benzo(b)fluoranthene	65 J	40 J	3500	410 U	260 J	150 J	400 U	68 J
Benzo(k)fluoranthene	68 J	45 J	2900	410 U	280 J	200 J	400 U	67 J
Benzo(a)pyrene	55 J	390 U	2900	410 U	190 J	120 J	400 U	51 J
Carbazole	400 U	390 U	2300	410 U	190 U	170 U	400 U	380 U
Chrysene	120 J	51 J	4800	410 U	100 J	220 J	400 U	94 J
Dibenzo(ah)anthracene	400 U	390 U	760 J	410 U	60 J	170 U	400 U	380 U
Indeno(1,2,3,cd)pyrene	400 U	390 U	2000	410 U	160 J	96 J	400 U	42 J
Sum of Carcinogens	366 a	136 a	23660 a	ND	1430 a	906 a	ND	382 a
<b>PROJECT SPECIFIC NON-CARCINOGENIC COMPOUNDS</b>								
Acenaphthene	400 U	150 J	210 J	410 U	390 U	370 U	400 U	380 U
Acenaphthylene	400 U	850	1900	410 U	390 U	43 J	400 U	380 U
Anthracene	400 U	390 U	3600	410 U	390 U	370 U	400 U	380 U
Benzo(ghi)perylene	400 U	390 U	1400 J	410 U	170 J	63 J	400 U	380 U
Dibenzofuran	400 U	52 J	1700 J	410 U	390 U	370 U	400 U	380 U
Fluoranthene	130 J	110 J	8600	410 U	380 J	370 J	400 U	350 J
Fluorene	400 U	390 U	3100	410 U	390 U	370 U	400 U	380 U
2-Methylnaphthalene	400 U	100 J	1300 J	410 U	390 U	370 U	400 U	380 U
Naphthalene	220 J	9400	5600	410 U	390 U	370 U	400 U	380 U
Phenanthrene	150 J	110 J	10000	410 U	150 J	80 J	400 U	330 J
Pyrene	100 J	48 J	6000	410 U	310 J	300 J	400 U	330 J
Sum of Non-Carcinogens	600 a	10820 a	43410 a	ND	1010 a	856 a	ND	390 a
Sum of Total PAH Compounds	966 a	10956 a	67070 a	ND	2500 a	1762 a	ND	772 a
<b>PHENOLIC COMPOUNDS</b>								
4-Chloro-3-methylphenol	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
2-Chlorophenol	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
o-Cresol	400 U	390 U	3000	410 U	390 U	370 U	400 U	380 U
p-Cresol	400 U	390 U	9300	410 U	390 U	370 U	400 U	380 U
2,4-Dichlorophenol	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
2,4-Dimethylphenol	400 U	390 U	910 J	410 U	390 U	370 U	400 U	380 U
2,4-Dinitrophenol	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
2-Methyl-4,6-dinitrophenol	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
2-Nitrophenol	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
4-Nitrophenol	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
Pentachlorophenol	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
Phenol	400 U	390 U	14000	410 U	390 U	370 U	400 U	380 U
2,4,5-Trichlorophenol	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
2,4,6-Trichlorophenol	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected. Note that the laboratory would have reported, with a J qualifier, any detected concentration below the stated quantitation limit but above the laboratory's method detection limit. The laboratory's method detection limit is typically about 10 percent of the stated quantitation limit in the table.

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01/24/94

TABLE 4.1-9 (cont.)

SOIL QUALITY DATA  
SURFICIAL SOIL SAMPLES  
SEMIVOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SS06	SS07	SS08	SS09	SS10	SS11	SS12	SS13
	03/11/92	03/12/92	03/11/92	03/11/92	03/11/92	03/11/92	03/11/92	03/11/92
OTHER SEMIVOLATILE ORGANIC COMPOUNDS								
Bis(2-chloroethoxy)methane	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Bis(2-chloroethyl)ether	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Bis(2-chloroisopropyl)ether	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Bis(2-ethylhexyl)phthalate	400 U	390 U	1900 U	410 U	280 J	350 J	85 J	100 J
4-Bromophenyl phenyl ether	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Butyl benzyl phthalate	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
4-Chloroaniline	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
2-Chloronaphthalene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
4-Chlorophenyl phenyl ether	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Di-n-butyl phthalate	400 U	50 J	1900 U	410 U	390 U	370 U	400 U	380 U
Di-n-octyl phthalate	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
1,2-Dichlorobenzene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
1,3-Dichlorobenzene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
1,4-Dichlorobenzene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
3,3-Dichlorobenzidine	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Diethyl phthalate	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Dimethyl phthalate	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
2,4-Dinitrotoluene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
2,6-Dinitrotoluene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Hexachlorobenzene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Hexachlorobutadiene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Hexachlorocyclopentadiene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Hexachloroethane	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
Isophorone	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
N-Nitrosodi-n-propylamine	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
N-Nitrosodiphenylamine	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
2-Nitroaniline	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
3-Nitroaniline	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
4-Nitroaniline	960 U	940 U	4600 U	990 U	940 U	900 U	960 U	930 U
Nitrobenzene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U
1,2,4-Trichlorobenzene	400 U	390 U	1900 U	410 U	390 U	370 U	400 U	380 U

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.  
 U Not detected. Note that the laboratory would have reported, with a J qualifier, any detected concentration below the stated quantitation limit but above the laboratory's method detection limit. The laboratory's method detection limit is typically about 10 percent of the stated quantitation limit in the table.

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01/24/94

TABLE 4.1-10 (cont.)

SOIL QUALITY DATA  
SURFICIAL SOIL SAMPLES  
PESTICIDES AND PCBs

(concentrations in ug/kg)

	SS06	SS07	SS08	SS09	SS10	SS11	SS12	SS11
	-----	-----	-----	-----	-----	-----	-----	-----
	03/11/92	03/13/92	03/11/92	03/11/92	03/11/92	03/11/92	03/11/92	03/12/92
<b>PESTICIDES</b>								
Aldrin	2.0 U	13 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
a-BHC	2.0 U	10 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
b-BHC	2.0 U	13 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
d-BHC	2.0 U	13 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
g-BHC (Lindane)	2.0 U	10 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
Alpha Chlordane	2.0 U	13 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
Gamma Chlordane	2.0 U	13 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
4,4'-DDE	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
4,4'-DDE	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
4,4'-DDT	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Dieldrin	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Endosulfan I	2.0 U	10 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
Endosulfan II	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Endosulfan Sulfate	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Endrin	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Endrin Aldehyde	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Endrin Ketone	4.0 U	20 U	24 U	4.1 U	12 U	3.7 U	4.0 U	3.3 U
Heptachlor	2.0 U	10 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
Heptachlor Epoxide	2.0 U	10 U	12 U	2.1 U	6.0 U	1.9 U	2.0 U	2.0 U
Methoxychlor	20 UJ	100 U	120 UJ	21 UJ	60 UJ	19 UJ	20 UJ	23 UJ
Toxaphene	1000 U	1000 U	6000 U	210 U	600 U	190 U	200 U	200 U
<b>PCBs</b>								
PCB-1016	200 U	200 U	1200 U	41 U	120 U	37 U	40 U	38 U
PCB-1221	400 U	400 U	2400 U	83 U	240 U	75 U	81 U	78 U
PCB-1232	200 U	200 U	1200 U	41 U	120 U	37 U	40 U	38 U
PCB-1242	200 U	200 U	1200 U	41 U	120 U	37 U	40 U	38 U
PCB-1248	200 U	200 U	1200 U	41 U	120 U	37 U	40 U	38 U
PCB-1254	200 U	200 U	1200 U	41 U	120 U	37 U	40 U	38 U
PCB-1260	200 U	200 U	1200 U	41 U	120 U	37 U	40 U	38 U

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected.

.008

01/24/94

TABLE 4.1-11 (cont.)

SOIL QUALITY DATA  
GROUND SURFACE SOIL SAMPLES  
INORGANIC COMPOUNDS

(concentrations in mg/kg)

	GS15	GS15	GS17
	-----	-----	-----
	08/31/91	08/31/93	09/01/93
Arsenic, total	20.2 J	5.2 J	6.2 J
Cyanide, total	4.5	0.20 U	0.53 U
Aluminum	--	--	--
Antimony	--	--	--
Barium	--	--	--
Beryllium	--	--	--
Cadmium	0.66 U	0.69 U	0.65 U
Calcium	--	--	--
Chromium, total	--	--	--
Cobalt	--	--	--
Copper	--	--	--
Iron	--	--	--
Lead	49.9	19.2	17.6
Magnesium	--	--	--
Manganese	--	--	--
Mercury	0.73	0.02 U	0.04 U
Nickel	--	--	--
Potassium	--	--	--
Selenium	1.3 J	1.3 J	0.47 UJ
Silver	--	--	--
Sodium	--	--	--
Thallium	--	--	--
Vanadium	--	--	--
Zinc	--	--	--

-----  
-- Not analyzed.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected.

J, .001

03/27/94

TABLE 4.1-12 (cont.)

SOIL QUALITY DATA  
GROUND SURFACE SOIL SAMPLES  
VOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	GS15 ----- 08/31/93	GS15 ----- 08/31/93	GS17 ----- 09/01/93
<b>BETX COMPOUNDS</b>			
Benzene	0.2 J	0.3 J	1.1 U
Ethyl Benzene	0.2 J	1.2 U	1.1 U
Toluene	0.3 J	0.4 J	1.1 U
m & p Xylene	0.3 J	0.4 J	2.2 U
o-Xylene	1.1 U	0.3 J	1.1 U
Sum of BETX	1.0 a	1.4 a	ND
<b>CHLORINATED COMPOUNDS</b>			
Bromodichloromethane	--	--	--
Carbon Tetrachloride	--	--	--
Chloroethane	--	--	--
Chloroform	--	--	--
Chloromethane	--	--	--
Chlorobenzene	--	--	--
Chlorodibromomethane	--	--	--
1,1-Dichloroethane	--	--	--
1,2-Dichloroethane	--	--	--
1,1-Dichloroethylene	--	--	--
1,2-Dichloroethylene	--	--	--
1,2-Dichloropropane	--	--	--
Cis-1,3-Dichloro-1-propene	--	--	--
Trans-1,3-Dichloro-1-propene	--	--	--
Methylene Chloride	--	--	--
Styrene	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--
Tetrachloroethylene	--	--	--
1,1,1-Trichloroethane	--	--	--
1,1,2-Trichloroethane	--	--	--
Trichloroethylene	--	--	--
Vinyl Chloride	--	--	--
<b>OTHER COMPOUNDS</b>			
Acetone	--	--	--
Bromoform	--	--	--
Bromomethane	--	--	--
Carbondisulfide	--	--	--
2-Hexanone	--	--	--
Methyl Ethyl Ketone	--	--	--
Methyl Isobutyl Ketone	--	--	--

-----  
-- Not analyzed.

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected. Note that the laboratory would have reported, with a J qualifier,

any detected concentration below the stated quantitation limit but above the

laboratory's method detection limit. The laboratory's method detection limit

is typically about 10 percent of the stated quantitation limit in the table.

3, .001

01/24/94

TABLE 4.1-13 (cont.)

SOIL QUALITY DATA  
GROUND SURFACE SOIL SAMPLES  
SEMIVOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	GS12	GS13	GS14	GS15	GS16	GS17
	-----	-----	-----	-----	-----	-----
	08/31/93	08/31/93	08/31/93	08/31/93	08/31/93	09/01/93
<b>CARCINOGENIC COMPOUNDS</b>						
Benzo (a) anthracene	820	530	230 J	470000	1500	1630
Benzo (b) fluoranthene	720	530	230 J	390000	1600	1700
Benzo (k) fluoranthene	700	360 J	180 J	300000	1600	1000
Benzo (a) pyrene	690	380	170 J	320000	1200	1200
Carbazole	100 J	530	44 U	20000 J	220 J	160 J
Chrysene	900	680	270 J	470000	1900	1400
Dibenzo (ah) anthracene	180 J	73 J	47 U	88000 J	140 J	190 J
Indeno (1, 2, 3, cd) pyrene	320 J	120 J	79 J	130000	230 J	320 J
Sum of Carcinogens	4430 a	3203 a	1153 a	2188000 a	8190 a	7570 a
<b>PROJECT SPECIFIC NON-CARCINOGENIC COMPOUNDS</b>						
Acenaphthene	180 J	47 J	150 J	420 U	160 J	68 J
Acenaphthylene	150 J	96 J	42 U	96000 J	110 J	510
Anthracene	250 J	1200	120 J	91000 J	270 J	520
Benzo (ghi) perylene	260 J	96 J	74 J	89000 J	220 J	240 J
Dibenzofuran	120 J	210 J	100 J	450 U	420 J	140 J
Fluoranthene	1400	960	640	440000	2900	1800
Fluorene	150 J	300 J	55 J	31000 J	230 J	280 J
2-Methylnaphthalene	80 J	320 J	50 U	540 U	600 J	110 J
Naphthalene	310 J	1000	230 J	27000 J	460 J	230 J
Phenanthrene	770	1100	480	200000	4100	1200
Pyrene	1100	770	450	430000	2200	1400
Sum of Non-Carcinogens	4770 a	6099 a	2299 a	1404000 a	11670 a	6498 a
Sum of Total PAH Compounds	9200 a	9302 a	3458 a	3592000 a	20060 a	14068 a
<b>PHENOLIC COMPOUNDS</b>						
4-Chloro-3-methylphenol	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--
o-Cresol	34 U	60 J	35 U	380 U	78 U	37 U
p-Cresol	36 U	200 J	37 U	410 U	84 U	40 U
2,4-Dichlorophenol	--	--	--	--	--	--
2,4-Dimethylphenol	230 U	240 U	230 U	2500 U	520 U	250 U
2,4-Dinitrophenol	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--
Phenol	44 U	110 J	45 U	490 U	100 U	48 U
2,4,5-Trichlorophenol	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--

-----  
-- Not analyzed.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered acceptable and usable.

U Not detected.

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01/24/94

TABLE 4.1-19 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
INORGANIC COMPOUNDS

(concentrations in mg/kg)

	SBS205 9.5-11.5' ----- 09/15/93	SBS208 17-19' ----- 09/15/93	SBS214 32-34' ----- 09/15/93	SBS304 7-9' ----- 09/16/93	SBS312 27-29' ----- 09/16/93	SBS502 2-4' ----- 10/07/93	SBS412 27-29' ----- 10/07/93	SBS710 22-24' ----- 10/07/93
Arsenic, total	1.7 B	1.3	17.7	2.0 BJ	1.7 BJ	11.0	56.2	8.0
Cyanide, total	0.12 U	0.12 U	0.46 B	0.12 U	4.1	0.93 BJ	3.0 J	0.29 BJ
Aluminum	--	--	--	--	--	--	--	--
Antimony	--	--	--	--	--	--	--	--
Barium	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--
Cadmium	0.73 U	1.7	0.72 U	0.79 B	0.73 U	1.0 B	0.70 U	0.72 U
Calcium	--	--	--	--	--	--	--	--
Chromium, total	--	--	--	--	--	--	--	--
Cobalt	--	--	--	--	--	--	--	--
Copper	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	--	--
Lead	2.8 J	4.0 J	3.0 J	2.9 J	2.9 J	44.4	3.2	3.0
Magnesium	--	--	--	--	--	--	--	--
Manganese	--	--	--	--	--	--	--	--
Mercury	0.08 U	0.13 U	0.08 U	0.04 U	0.04 U	0.04 U	0.02 U	0.02 U
Nickel	--	--	--	--	--	--	--	--
Potassium	--	--	--	--	--	--	--	--
Selenium	0.52 U	0.52 U	0.74 B	0.51 UJ	0.52 UJ	2.0 J	0.36 UJ	0.37 UJ
Silver	--	--	--	--	--	--	--	--
Sodium	--	--	--	--	--	--	--	--
Thallium	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--
Zinc	--	--	--	--	--	--	--	--

-----  
-- Not analyzed.

B The reported value is less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected.

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03/27/94

TABLE 4.1-20 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
VOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SBS312 27-29' ----- 09/16/93	SBS502 2-4' ----- 10/07/93	SBS612 27-29' ----- 10/07/93	SBS710 22-24' ----- 10/07/93	SBS902 2-4' ----- 11/01/93	SBS904 7-9' ----- 11/01/93	SBS909 17-19' ----- 11/01/93	SBS912 27-29' ----- 11/01/93
<b>BETX COMPOUNDS</b>								
Benzene	1.2 U	58 J	270	18	0.7 J	4.4	0.3 J	61
Ethyl Benzene	1.2 U	100	94	39	1.1 J	0.3 J	0.3 J	1.2 U
Toluene	1.2 U	500	320	6.0	1.2 U	1.2 U	1.1 U	1.2 U
m & p Xylene	2.5 U	6300	18	4.9	2.3 U	2.4 U	2.2 U	2.4 U
o-Xylene	1.2 U	1900	20	6.0	1.2 U	1.2 U	1.1 U	0.4 J
Sum of BETX	ND	9358 a	722	71.9	1.8 a	4.7 a	0.6 a	61.4 a
<b>CHLORINATED COMPOUNDS</b>								
Bromodichloromethane	--	--	--	--	--	--	--	--
Carbon Tetrachloride	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--
Chlorodibromomethane	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	--	--	--	--	--	--	--	--
1,2-Dichloroethylene	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--
Cis-1,3-Dichloro-1-propene	--	--	--	--	--	--	--	--
Trans-1,3-Dichloro-1-propene	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--
Tetrachloroethylene	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--
Trichloroethylene	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--
<b>OTHER COMPOUNDS</b>								
Acetone	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--
Bromomethane	--	--	--	--	--	--	--	--
Carbonylsulfide	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--
Methyl Ethyl Ketone	--	--	--	--	--	--	--	--
Methyl Isobutyl Ketone	--	--	--	--	--	--	--	--

-----  
-- Not analyzed.

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected. Note that the laboratory would have reported, with a J qualifier, any detected concentration below the stated quantitation limit but above the laboratory's method detection limit. The laboratory's method detection limit is typically about 10 percent of the stated quantitation limit in the table.

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01/24/94

TABLE 4.1-21 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
SEMIVOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SBS312 27-29' ----- 09/15/93	SBS302 2-4' ----- 10/07/93	SBS612 27-29' ----- 10/07/93	SBS710 22-24' ----- 10/07/93	SBS702 2-4' ----- 11/01/93	SBS304 7-9' ----- 11/01/93	SBS703 17-19' ----- 11/01/93	SBS312 27-29' ----- 11/01/93
<b>CARCINOGENIC COMPOUNDS</b>								
Benzo(a)anthracene	52 U	1600000	5300 U	48 U	49 U	48 U	48 U	49 U
Benzo(b)fluoranthene	37 U	1300000	3800 U	34 U	35 U	34 U	34 U	35 U
Benzo(k)fluoranthene	71 U	930000	7300 U	65 U	67 U	65 U	65 U	67 U
Benzo(a)pyrene	53 U	950000	5500 U	43 U	50 U	49 U	49 U	50 U
Carbazole	53 U	450000 J	5400 U	49 U	50 U	49 U	49 U	50 U
Chrysene	43 U	1600000	4400 U	39 U	40 U	39 U	39 U	40 U
Dibenzo(ah)anthracene	57 U	120000 J	5800 U	52 U	53 U	52 U	52 U	53 U
Indeno(1,2,3-cd)pyrene	52 U	360000 J	5300 U	48 U	49 U	48 U	48 U	49 U
Sum of Carcinogens	ND	7110000 a	ND	ND	ND	ND	ND	ND
<b>PROJECT SPECIFIC NON-CARCINOGENIC COMPOUNDS</b>								
Acenaphthene	46 U	86000 J	4700 U	42 U	43 U	42 U	42 U	43 U
Acenaphthylene	51 U	240000 J	5200 U	47 U	48 U	47 U	47 U	48 U
Anthracene	43 U	540000 J	4400 U	39 U	40 U	39 U	39 U	40 U
Benzo(ghi)perylene	50 U	290000 J	5200 U	46 U	47 U	46 U	46 U	47 U
Dibenzofuran	49 U	580000 J	5100 U	45 U	47 U	45 U	45 U	47 U
Fluoranthene	57 U	2300000	5900 U	53 U	56 J	53 U	53 U	54 U
Fluorene	52 U	1300000	5400 U	48 U	49 U	48 U	48 U	49 U
2-Methylnaphthalene	59 U	620000 J	6100 U	55 U	56 U	55 U	55 U	56 U
Naphthalene	56 U	1000000	5700 U	51 U	52 U	64 J	51 U	52 U
Phenanthrene	48 U	3800000	4900 U	44 U	60 J	44 U	44 U	45 U
Pyrene	51 U	1700000	5200 U	47 U	51 J	47 U	47 U	48 U
Sum of Non-Carcinogens	ND	12456000 a	ND	ND	167 a	64 a	ND	ND
Sum of Total PAH Compounds	ND	19766000 a	ND	ND	167 a	64 a	ND	ND
<b>PHENOLIC COMPOUNDS</b>								
4-Chloro-3-methylphenol	--	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--	--
o-Cresol	41 U	2000 U	24000 J	1600	39 U	38 U	38 U	160 J
p-Cresol	45 U	2100 U	75000	150 J	42 U	41 U	41 U	42 U
2,4-Dichlorophenol	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	280 U	13000 U	28000 U	1200	260 U	250 U	250 U	260 U
2,4-Dinitrophenol	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	--	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--	--	--
Phenol	54 U	2600 U	180000	240 J	51 U	49 U	49 U	51 U
2,4,5-Trichlorophenol	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--	--

-----  
-- Not analyzed.

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered acceptable and usable.

U Not detected.

sbj.prn

01/24/94

TABLE 4.1-19 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
INORGANIC COMPOUNDS

(concentrations in mg/kg)

	SB4212 27-29'	SB4302 2-4'	SB4304 7-9'	SB4308 17-19'		SB4312 27-29'	SB4402 2-4'	SB4404 7-9'
	-----		-----			-----		-----
	09/23/93	09/15/93	09/15/93	09/15/93	09/15/93 Sample	09/15/93 Duplicate	09/20/93	09/23/93
Arsenic, total	26.7	1.1 B	6.0	5.2	5.0	23.4	5.5 J	5.3 J
Cyanide, total	0.70 B	0.12 U	0.12 U	0.12 U	0.12 U	0.63 U	0.27 U	0.35 U
Aluminum	--	--	--	--	--	--	--	--
Antimony	--	--	--	--	--	--	--	--
Barium	--	--	--	--	--	--	--	--
Beryllium	--	--	--	--	--	--	--	--
Cadmium	0.89 BJ	0.69 U	0.70 U	0.71 U	0.70 U	0.72 U	0.69 U	0.73 U
Calcium	--	--	--	--	--	--	--	--
Chromium, total	--	--	--	--	--	--	--	--
Cobalt	--	--	--	--	--	--	--	--
Copper	--	--	--	--	--	--	--	--
Iron	--	--	--	--	--	--	1230	1320
Lead	3.4	2.8 J	1.6 J	1.8 J	1.7 J	2.6 J	16.3 J	2.2 J
Magnesium	--	--	--	--	--	--	--	--
Manganese	--	--	--	--	--	--	--	--
Mercury	0.02 U	0.11	0.11 U	0.09 U	0.07 U	0.08 U	0.02 U	0.02 U
Nickel	--	--	--	--	--	--	--	--
Potassium	--	--	--	--	--	--	--	--
Selenium	0.38 U	0.49 U	0.50 U	0.51 U	0.50 U	0.52 U	0.88 BJ	0.52 U
Silver	--	--	--	--	--	--	--	--
Sodium	--	--	--	--	--	--	--	--
Thallium	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--	--
Zinc	--	--	--	--	--	--	--	--

-----  
-- Not analyzed.

B The reported value is less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected.

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03/27/94

TABLE 4.1-19 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
INORGANIC COMPOUNDS

(concentrations in mg/kg)

	SB4406 12-14' ----- 09/20/93	SB4408 17-19' ----- 09/20/93	SB4412 27-29' ----- 09/20/93	SB4502 2-4' ----- 09/27/93	SB4504 7-9' ----- 09/27/93	SB4509 17-19' ----- 09/27/93	SB4513 29.5-31.5' ----- 09/27/93	09/27/93 Sample	09/27/93 Duplicate
Arsenic, total	--	10.3 J	56.8 J	15.7	3.6	4.8	13.8	18.3	
Cyanide, total	--	1.1 U	1.6 U	19.7	0.12 U	0.12 U	0.53 B	1.4 B	
Aluminum	--	--	--	--	--	--	--	--	
Antimony	--	--	--	--	--	--	--	--	
Barium	--	--	--	--	--	--	--	--	
Beryllium	--	--	--	--	--	--	--	--	
Cadmium	--	0.69 U	0.73 U	0.82 U	0.72 U	1.0 B	0.72 U	0.72 U	
Calcium	--	--	--	--	--	--	--	--	
Chromium, total	--	--	--	--	--	--	--	--	
Cobalt	--	--	--	--	--	--	--	--	
Copper	--	--	--	--	--	--	--	--	
Iron	2790	3440	10800	--	--	--	--	--	
Lead	--	2.5 J	3.9 J	41.1	2.9	2.8	2.7	3.6	
Magnesium	--	--	--	--	--	--	--	--	
Manganese	--	--	--	--	--	--	--	--	
Mercury	--	0.02 U	0.02 U	0.54	0.02 U	0.02 U	0.02 U	0.02 U	
Nickel	--	--	--	--	--	--	--	--	
Potassium	--	--	--	--	--	--	--	--	
Selenium	--	0.43 UJ	0.52 UJ	5.8 J	0.17 U	0.40 BJ	1.9 J	0.50 BJ	
Silver	--	--	--	--	--	--	--	--	
Sodium	--	--	--	--	--	--	--	--	
Thallium	--	--	--	--	--	--	--	--	
Vanadium	--	--	--	--	--	--	--	--	
Zinc	--	--	--	--	--	--	--	--	

-- Not analyzed.

B The reported value is less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected.

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03/27/94

TABLE 4.1-20 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
VOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SB4402	SB4404	SB4408	SB4410	SB4412	SB4502	SB4504	SB4508
	2-4'	7-9'	17-19'	22-24'	27-29'	2-4'	7-9'	17-19'
	09/20/91	09/20/91	09/20/91	09/20/91	09/20/91	09/27/91	09/27/91	09/27/91
<b>BETX COMPOUNDS</b>								
Benzene	1.2 J	1.2 U	1.2 U	0.6 J	8.0	2.8 J	0.6 J	310
Ethyl Benzene	2.6 U	1.2 J	1.7	8.6	4.2	1.4 U	1.2 U	100
Toluene	23 J	1.2 U	1.2 U	2.7	1.7	1.9 J	0.5 J	250
m & p Xylene	5.2 U	2.3 U	2.1 J	1.4 J	0.5 J	0.8 J	0.4 J	23 J
o-Xylene	2.6 U	0.4 J	1.5	3.2	0.9 J	0.6 J	0.2 J	130
Sum of BETX	24.2 a	1.6 a	5.3 a	16.5 a	15.3 a	6.1 a	1.7 a	1013 a
<b>CHLORINATED COMPOUNDS</b>								
Bromodichloromethane	--	--	--	--	--	--	--	--
Carbon Tetrachloride	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--
Chloromethane	--	--	--	--	--	--	--	--
Chlorobenzene	--	--	--	--	--	--	--	--
Chlorodibromomethane	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--
1,1-Dichloroethylene	--	--	--	--	--	--	--	--
1,2-Dichloroethylene	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--
Cis-1,3-Dichloro-1-propene	--	--	--	--	--	--	--	--
Trans-1,3-Dichloro-1-propene	--	--	--	--	--	--	--	--
Methylene Chloride	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--
Tetrachloroethylene	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--
Trichloroethylene	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--
<b>OTHER COMPOUNDS</b>								
Acetone	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--
Bromomethane	--	--	--	--	--	--	--	--
Carbonylsulfide	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	--
Methyl Ethyl Ketone	--	--	--	--	--	--	--	--
Methyl Isobutyl Ketone	--	--	--	--	--	--	--	--

-- Not analyzed.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered to be acceptable and usable.

U Not detected. Note that the laboratory would have reported, with a J qualifier, any detected concentration below the stated quantitation limit but above the laboratory's method detection limit. The laboratory's method detection limit is typically about 10 percent of the stated quantitation limit in the table.

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01/24/94

TABLE 4.1-21 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
SEMIVOLATILE ORGANIC COMPOUNDS

(concentrations in ug/kg)

	SB4109 17-19'		SB4112 27-29'	SB4402 2-4'	SB4404 7-9'	SB4408 17-19'	SB4412 27-29'	SB4502 2-4'
	-----		-----	-----	-----	-----	-----	-----
	09/15/93 Sample	09/15/93 Duplicate	09/15/93	09/20/93	09/20/93	09/20/93	09/20/93	09/27/93
<b>CARCINOGENIC COMPOUNDS</b>								
Benzo(a) anthracene	43 U	48 U	49 U	85 J	48 U	95 U	260 U	64000
Benzo(b) fluoranthene	34 U	34 U	35 U	140 J	34 U	68 U	180 U	55000
Benzo(k) fluoranthene	66 U	66 U	67 U	74 U	66 U	130 U	350 U	31000
Benzo(a) pyrene	50 U	50 U	51 U	58 J	50 U	98 U	270 U	42000
Carbazole	49 U	49 U	50 U	55 U	140 J	97 U	260 U	7500 J
Chrysene	40 U	40 U	41 U	190 J	40 U	79 U	210 U	67000
Dibenzo(ah) anthracene	53 U	53 U	54 U	59 U	53 U	100 U	280 U	15000 J
Indeno(1,2,3,cd) pyrene	49 U	49 U	50 U	54 U	49 U	96 U	260 U	20000 J
Sum of Carcinogens	ND	ND	ND	473 a	140 a	ND	ND	302500 a
<b>PROJECT SPECIFIC NON-CARCINOGENIC COMPOUNDS</b>								
Acenaphthene	43 U	43 U	44 U	48 U	58 J	84 U	230 U	2500 U
Acenaphthylene	47 U	47 U	48 U	53 U	1100	94 U	250 U	13000 J
Anthracene	40 U	40 U	40 U	71 J	40 U	78 U	210 U	24000
Benzo(ghi)perylene	47 U	47 U	48 U	80 J	47 U	93 U	250 U	17000 J
Dibenzofuran	46 U	46 U	47 U	51 U	46 U	91 U	250 U	7000 J
Fluoranthene	53 U	53 U	54 U	85 J	53 U	110 U	290 U	98000
Fluorene	49 U	49 U	50 U	54 U	49 U	96 U	260 U	13000 J
2-Methylnaphthalene	55 U	55 U	57 U	110 J	55 U	110 U	300 U	4800 J
Naphthalene	52 U	52 U	53 U	52 J	240 J	4000	280 U	11000 J
Phenanthrene	45 U	45 U	46 U	780	45 U	88 U	240 U	67000
Pyrene	48 U	48 U	49 U	110 J	48 U	94 U	260 U	65000
Sum of Non-Carcinogens	ND	ND	ND	1288 a	1398 a	4000	ND	319800 a
Sum of Total PAH Compounds	ND	ND	ND	1761 a	1538 a	4000	ND	621300 a
<b>PHENOLIC COMPOUNDS</b>								
4-Chloro-3-methylphenol	--	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--	--
o-Cresol	39 U	39 U	7100 J	43 U	39 U	140 J	13000	2300 U
p-Cresol	42 U	42 U	15000	48 J	42 U	82 U	32000	2400 U
2,4-Dichlorophenol	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	260 U	260 U	3900	290 U	260 U	510 U	6000	15000 U
2,4-Dinitrophenol	--	--	--	--	--	--	--	--
2-Methyl-4,6-dinitrophenol	--	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--	--
Pentachlorophenol	--	--	--	--	--	--	--	--
Phenol	50 U	50 U	43000	75 J	50 U	99 U	41000	2900 U
2,4,5-Trichlorophenol	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--	--

-----  
-- Not analyzed.

ND Not detected.

a Calculated using some or all values that are estimates.

J Associated value is qualified as an estimate. The value is considered acceptable and usable.

U Not detected.

sbj.prn

01/24/94

TABLE 4.1-22 (cont.)

SOIL QUALITY DATA  
SOIL BORING SAMPLES  
PESTICIDES AND PCBs

(concentrations in ug/kg)

	SB1107 14.5-16.5' ----- 10/05/93	SB1110 22-24' ----- 10/05/93	SB4202 2-4' ----- 09/21/93	SB4402 2-4' ----- 09/20/93
<b>PESTICIDES</b>				
Aldrin	18 U	2.1 U	460 U	9.9 U
a-BHC	18 U	2.1 U	460 U	9.9 U
b-BHC	18 U	2.1 U	460 U	9.9 U
d-BHC	18 U	2.1 U	460 U	9.9 U
g-BHC (Lindane)	18 U	2.1 U	460 U	9.9 U
Alpha Chlordane	18 U	2.1 U	460 U	9.9 U
Gamma Chlordane	18 U	2.1 U	460 U	9.9 U
4,4'-DCC	35 U	4.0 U	890 U	19 U
4,4'-DDE	35 U	4.0 U	890 U	19 U
4,4'-DDT	35 U	4.0 U	890 U	19 U
Dieldrin	35 U	4.0 U	890 U	19 U
Endosulfan I	18 U	2.1 U	460 U	9.9 U
Endosulfan II	35 U	4.0 U	890 U	19 U
Endosulfan Sulfate	35 U	4.0 U	890 U	19 U
Endrin	35 U	4.0 U	890 U	19 U
Endrin Aldehyde	35 U	4.0 U	890 U	19 U
Endrin Ketone	35 U	4.0 U	890 U	19 U
Heptachlor	18 U	2.1 U	460 U	9.9 U
Heptachlor Epoxide	18 U	2.1 U	460 U	9.9 U
Methoxychlor	180 U	21 U	4600 U	99 U
Toxaphene	1800 U	210 U	46000 U	990 U
<b>PCBs</b>				
PCB-1016	350 U	40 U	8900 U	190 U
PCB-1221	720 U	82 U	18000 U	390 U
PCB-1232	350 U	40 U	8900 U	190 U
PCB-1242	350 U	40 U	8900 U	190 U
PCB-1248	810 P	38 J	38000 C	190 U
PCB-1254	350 U	40 U	8900 U	190 U
PCB-1260	350 U	40 U	8900 U	190 U

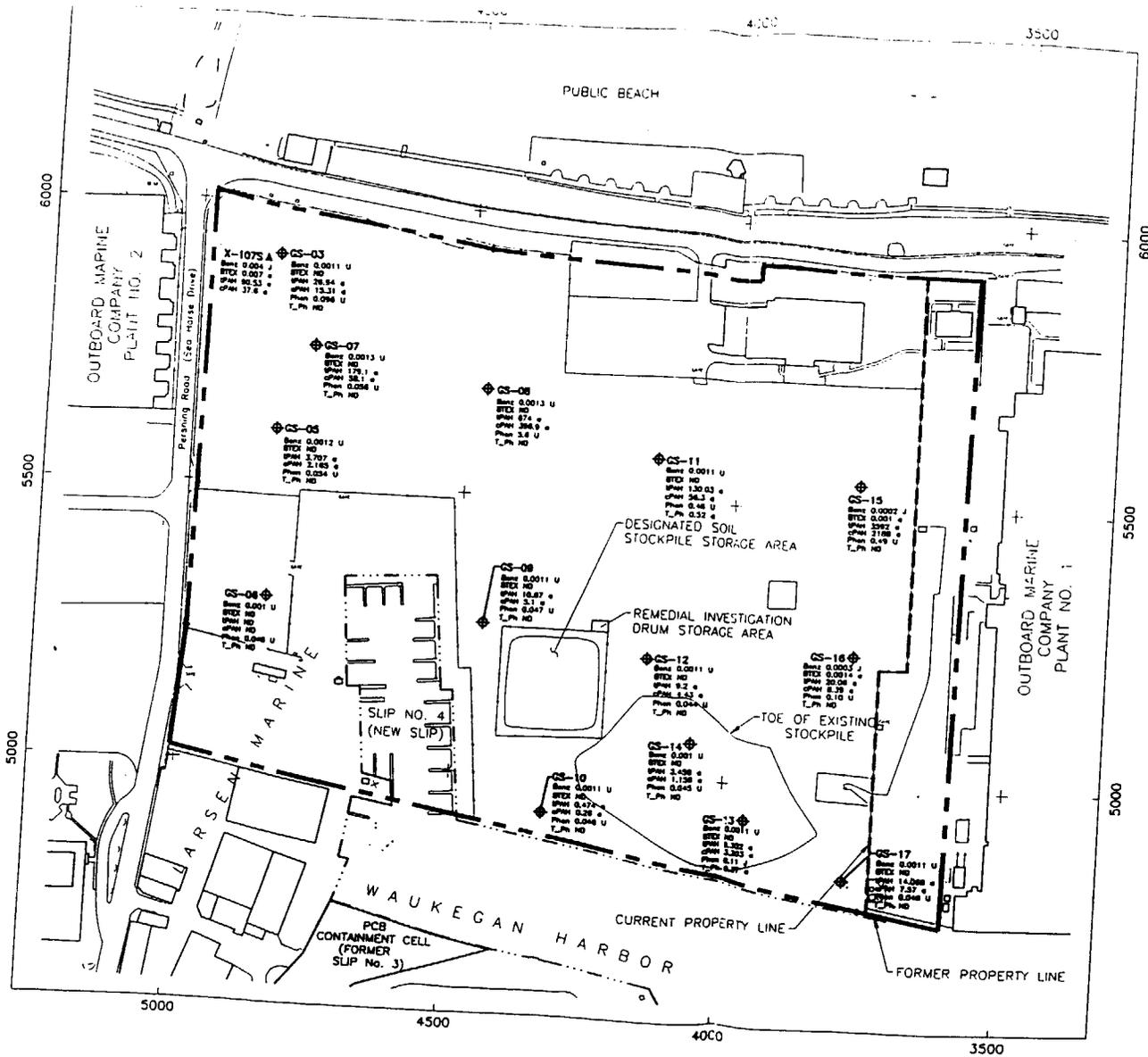
-----  
C The presence of this compound was confirmed by GC/MS analysis.

P Greater than 25 percent difference for detected concentrations between primary and confirmation GC columns. Result reported is the lower of the two values.

U Not detected.

.015

01/24/94



0 200  
SCALE IN FEET

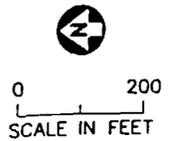
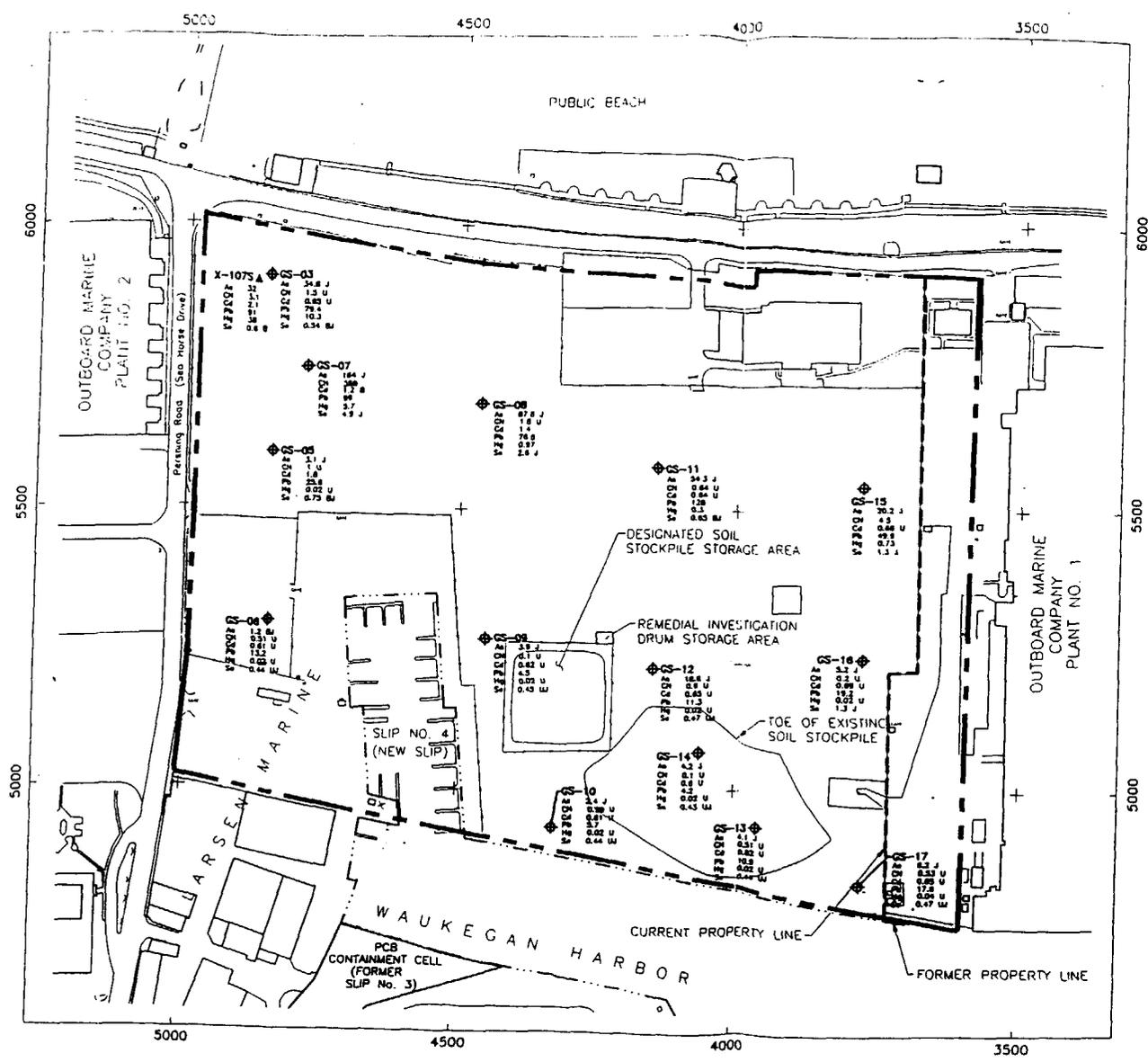
- ◆ CS-18 Ground Surface Soil Sample Location
- ▲ X-105 Illinois Environmental Protection Agency Soil Sample Location

NOTES:

- Concentrations in mg/kg.
- See Analytical Data Tables For Explanation of Data Qualifiers.
- Benz - Benzene
- BTEX - Sum of Benzene, Toluene, Ethyl Benzene, and Xylenes
- tPAH - Sum of Total PAHs
- cPAH - Sum of Total Carcinogenic PAHs
- Phen - Phenol
- T\_Ph - Sum of Total Phenolic Compounds
- ND - Not Detected

Figure 7.4-1  
DISTRIBUTION OF VOLATILE AND SEMIVOLATILE ORGANIC COMPOUNDS IN GROUND SURFACE SOILS  
Waukegan Manufactured Gas & Coke Plant

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- ◆ GS-16 Ground Surface Soil Sample Location
- ▲ X-105 Illinois Environmental Protection Agency Soil Sample Location

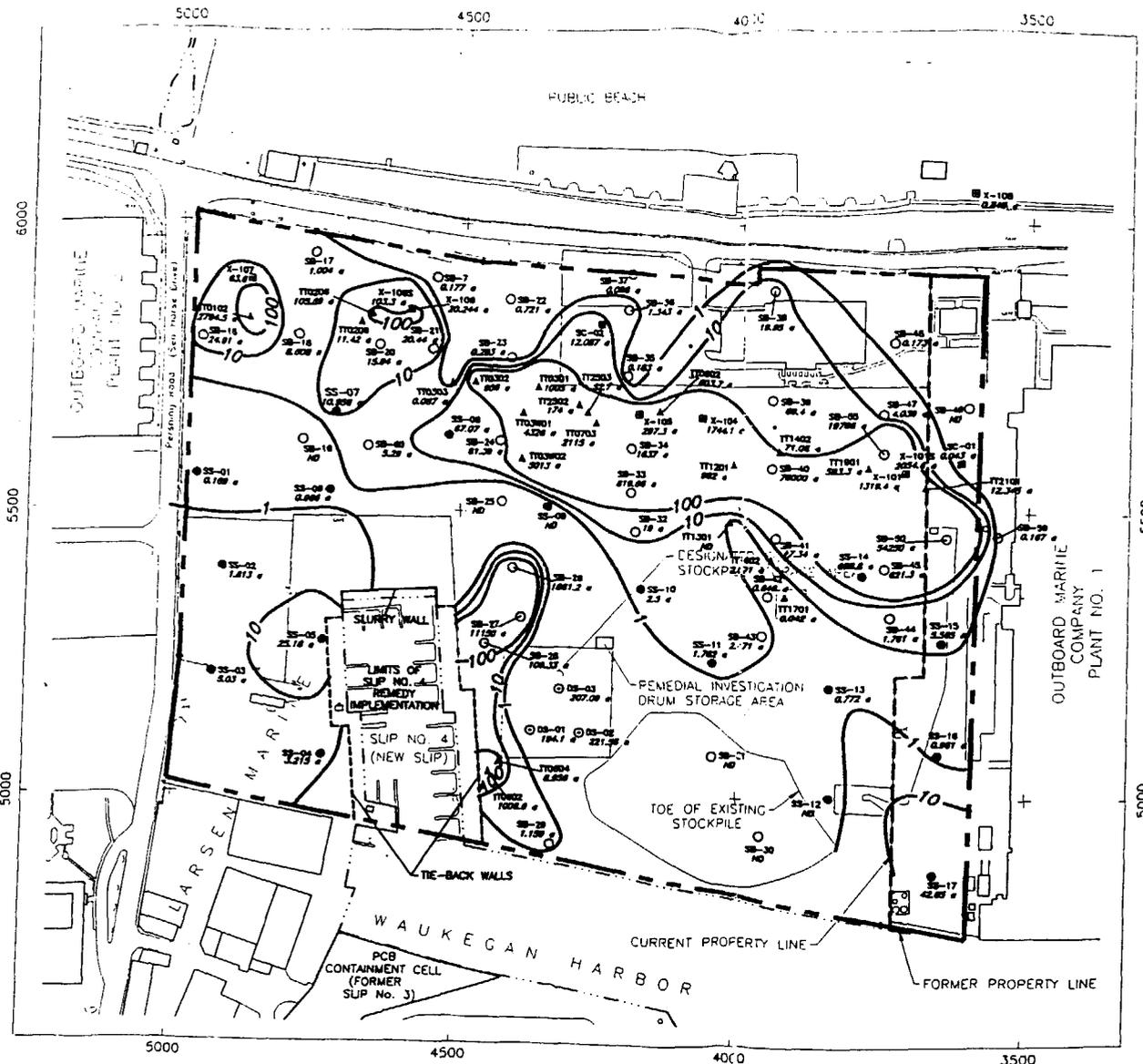
NOTES:

Concentrations in mg/kg.  
See Analytical Data Tables For Explanation of Data Qualifiers.

- As - Arsenic
- CN - Cyanide
- Cd - Cadmium
- Pb - Lead
- Hg - Mercury
- Se - Selenium

Figure 7.4-2  
DISTRIBUTION OF INORGANIC COMPOUNDS  
IN GROUND SURFACE SOILS  
Waukegan Manufactured Gas & Coke Plant

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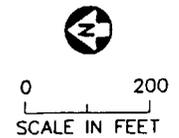
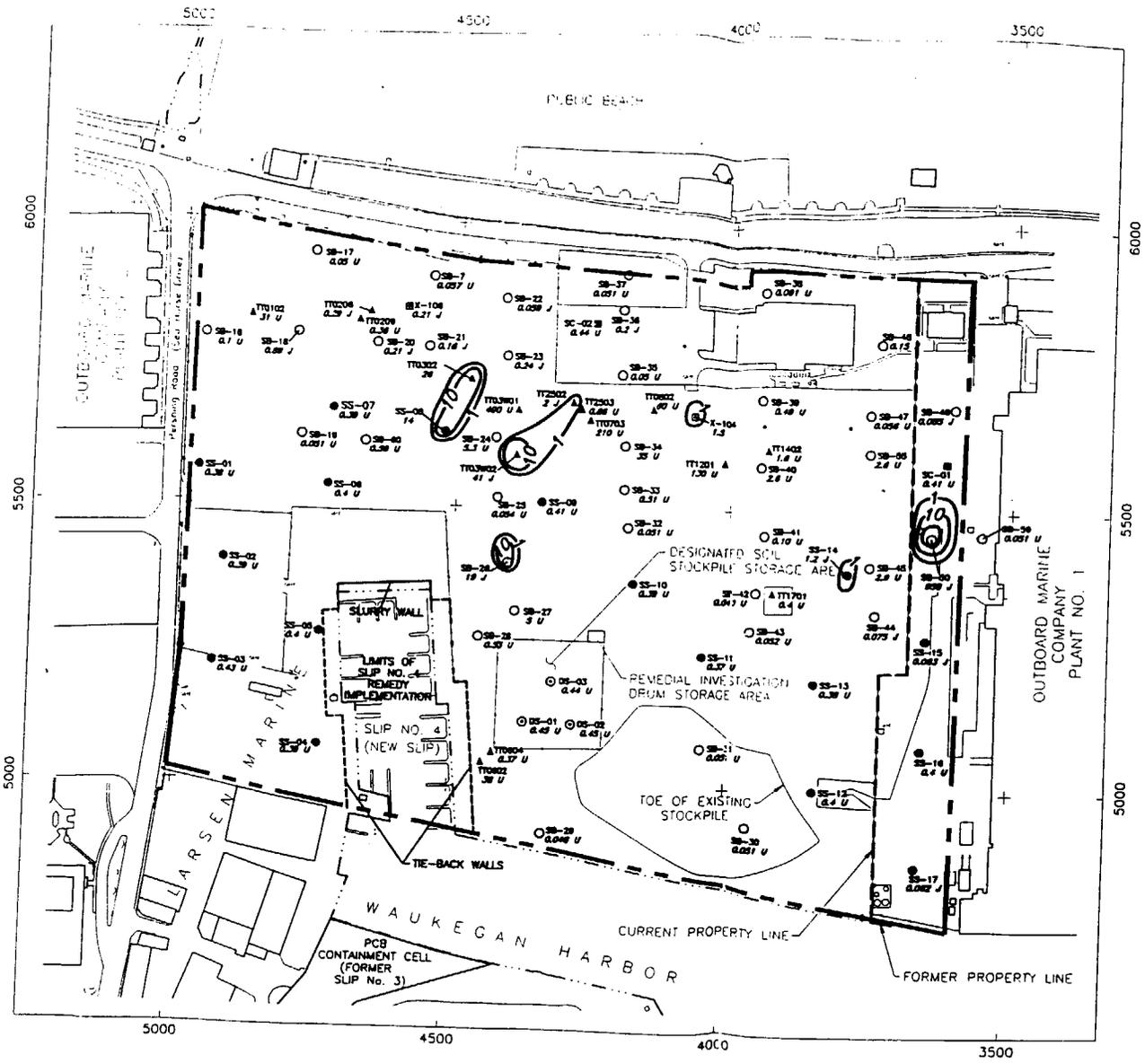
- SS-01 Designated Soil Stockpile Sample Location.
- X-106 Illinois Environmental Protection Agency Soil Sample Location
- SS-07 Surficial Soil Sample Location
- SS-01 Surficial Soil Sample Location
- ▲ TT0804 Test Trench Sample Location
- SS-33 Soil Boring Location
- SS-109 Canonic Soil Boring
- 2.5 Total PAH Concentration (mg/kg)
- ND Not Detected
- 10— Total PAH Concentrations In Soil (Contours Are Approximate)

NOTE:  
 See Analytical Data Tables For Explanation Of Data Qualifiers.  
 Soil Stockpile Concentrations Are Located At Depths Below The Base Of The Soil Stockpile  
 Designated Soil Stockpile Concentrations Are From Within The Containment Cell And Are Excluded From Contouring.

Sample Matrices And Concentrations Of Samples >1000ppm TPAH

SAMPLE	TPAH CONCENTRATION	MATRIX
TT0102	2784.3	Wabily Contaminated Sand
TT03W01	4326	Industrial Pond Deposit
TT03W02	5013	Wabily Contaminated Sand
TT0802	1006.9	Wabily Contaminated Soil
TT0703	2115	Wabily Contaminated Soil
X-101	1319.4	Not Known
X-1015	2054.6	Not Known
X-104	1744.1	Not Known
SS-26	1861.2	Coal And Coke Fines
SS-27	11,150	Sand
SS-34	1637	Wabily Contaminated Sand With Coal Fines
SS-40	76,000	Wabily Contaminated Soil
SS-50	54,250	Wabily Contaminated Soil
SS-33	16,756	Wabily Contaminated Soil

Figure 7.6-1  
 DISTRIBUTION OF TOTAL PAH CONCENTRATIONS IN VADOSE ZONE SOILS DEPTH 0.5'-4.5'  
 Waukegan Manufactured Gas & Coke Plant



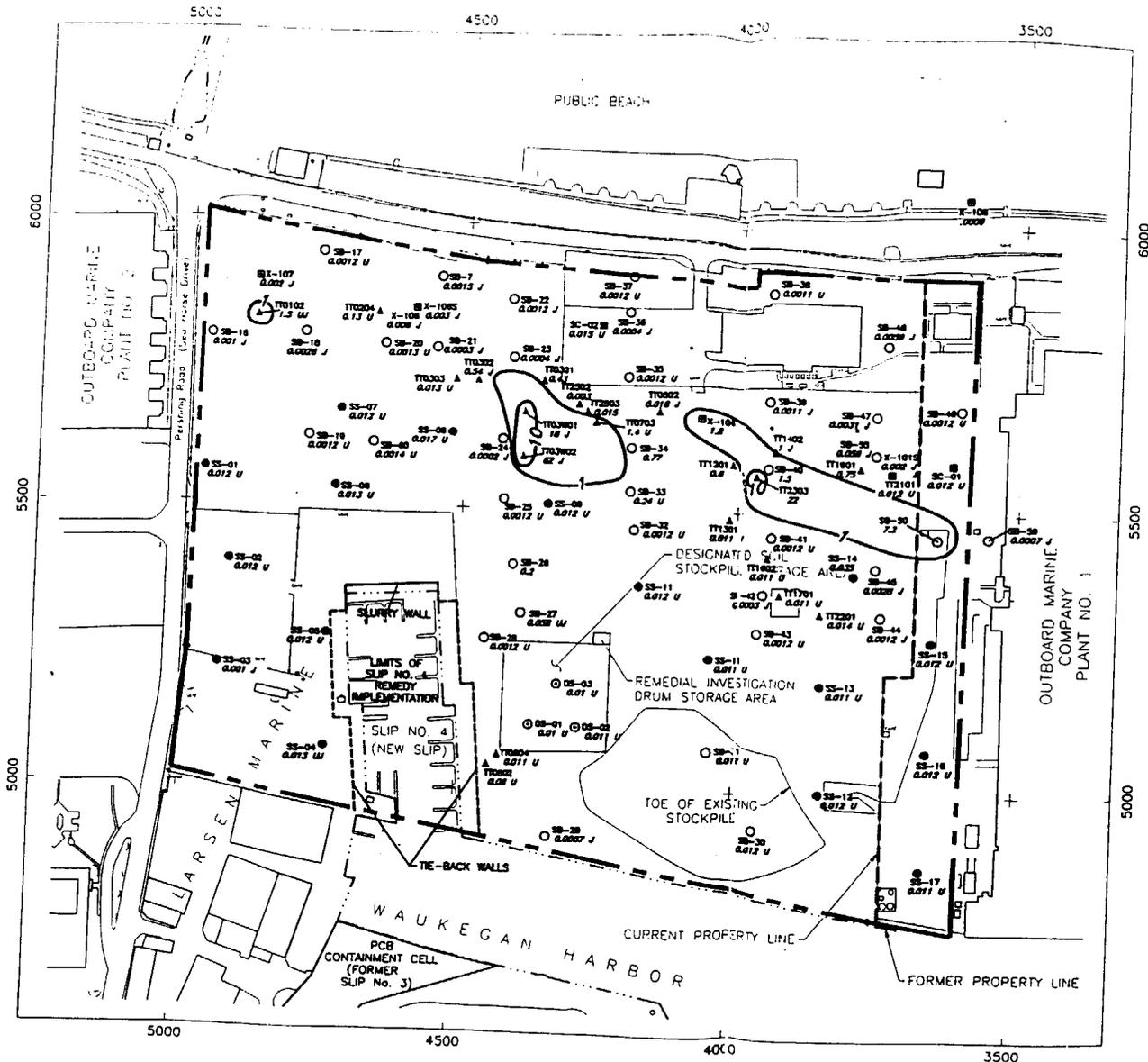
- SS-01 Designated Soil Stockpile Sample Location.
- SX-108 Illinois Environmental Protection Agency Soil Sample Location
- SS-07 Surficial Soil Sample Location
- SS-01 Surficial Soil Sample Location
- ▲ TT004 Test Trench Sample Location
- SB-33 Soil Boring Location
- 210 Phenol Concentration (mg/kg)
- 10 — Phenol Concentrations In Soil (Contours Are Approximate)

NOTE:  
 See Analytical Data Tables For Explanation Of Data Qualifiers.  
 Soil Stockpile Concentrations Are Located At Depths Below The Base Of The Soil Stockpile.  
 Designated Soil Stockpile Concentrations Are From Within The Containment Cell And Are Excluded From Contouring.

Figure 7.6-3  
 DISTRIBUTION OF PHENOL  
 CONCENTRATIONS IN VADOSE ZONE SOILS  
 DEPTH 0.5'-4.5'  
 Waukegan Manufactured Gas & Coke Plant

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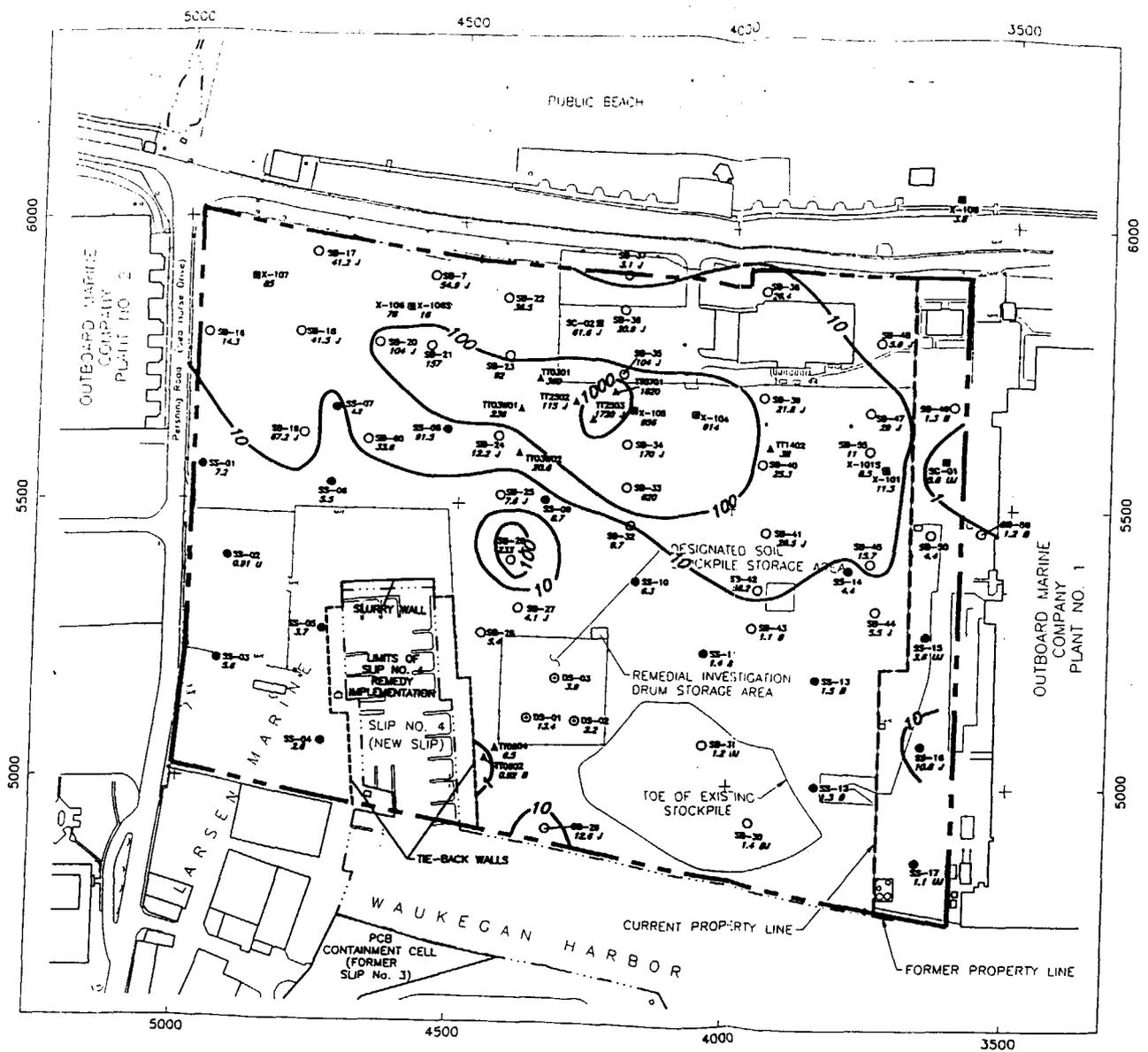


- SS-01 Designated Soil Stockpile Sample Location.
- SX-106 Illinois Environmental Protection Agency: Soil Sample Location
- SS-07 Surficial Soil Sample Location
- SC-01 Surficial Soil Sample Location
- ▲TT0004 Test Trench Sample Location
- SB-33 Soil Boring Location
- 1.5 Benzene Concentration (mg/kg)
- ND Not Detected
- 10- Benzene Concentrations In Soil (Contours Are Approximate)

NOTE:  
 See Analytical Data Tables For Explanation Of Data Qualifiers.  
 Soil Stockpile Concentrations Are Located At Depths Below The Base Of The Soil Stockpile.  
 Designated Soil Stockpile Concentrations Are From Within The Containment Cell And Are Excluded From Contouring.

Figure 7.6-4  
 DISTRIBUTION OF BENZENE  
 CONCENTRATIONS IN VADOSE ZONE SOILS  
 DEPTH 0.5'-4.5'  
 Waukegan Manufactured Gas & Coke Plant

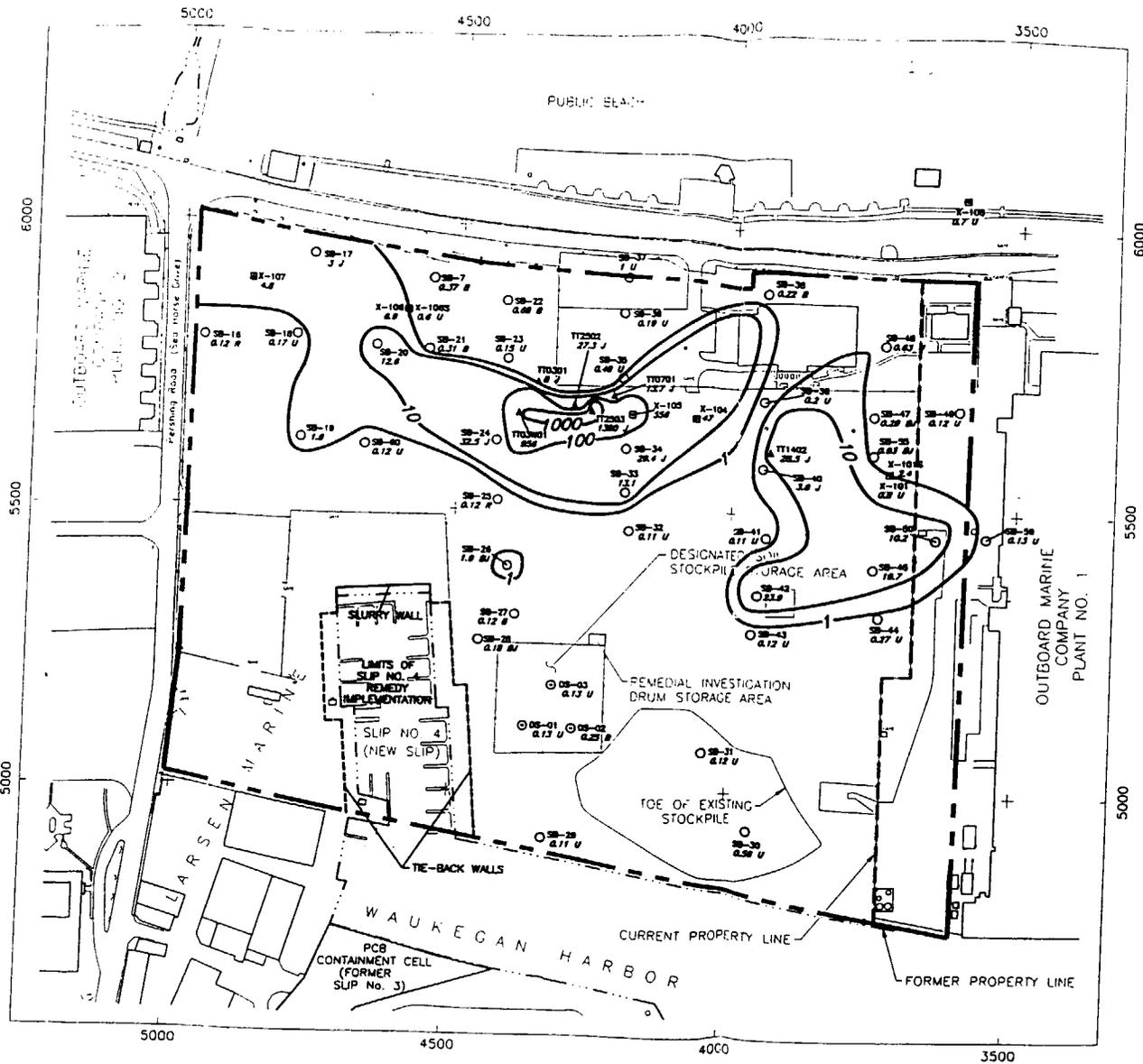
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- SS-01 Designated Soil Stockpile Sample Location.
- X-106 Illinois Environmental Protection Agency Soil Sample Location
- SS-07 Surficial Soil Sample Location
- SC-01 Surficial Soil Sample Location
- ▲TT0804 Test Trench Sample Location
- SB-33 Soil Boring Location
- 29.5 Arsenic Concentration (mg/kg)
- ND Not Detected
- 10- Arsenic Concentrations In Soil (Contours Are Approximate)

NOTE:  
 See Analytical Data Tables For Explanation Of Data Qualifiers.  
 Soil Stockpile Concentrations Are Located At Depths Below The Base Of The Soil Stockpile.  
 Designated Soil Stockpile Concentrations Are From Within The Containment Cell And Are Excluded From Contouring.

Figure 7.6-5  
 DISTRIBUTION OF ARSENIC  
 CONCENTRATIONS IN VADOSE ZONE SOILS  
 DEPTH 0.5'-4.5'  
 Waukegan Manufactured Gas & Coke Plant



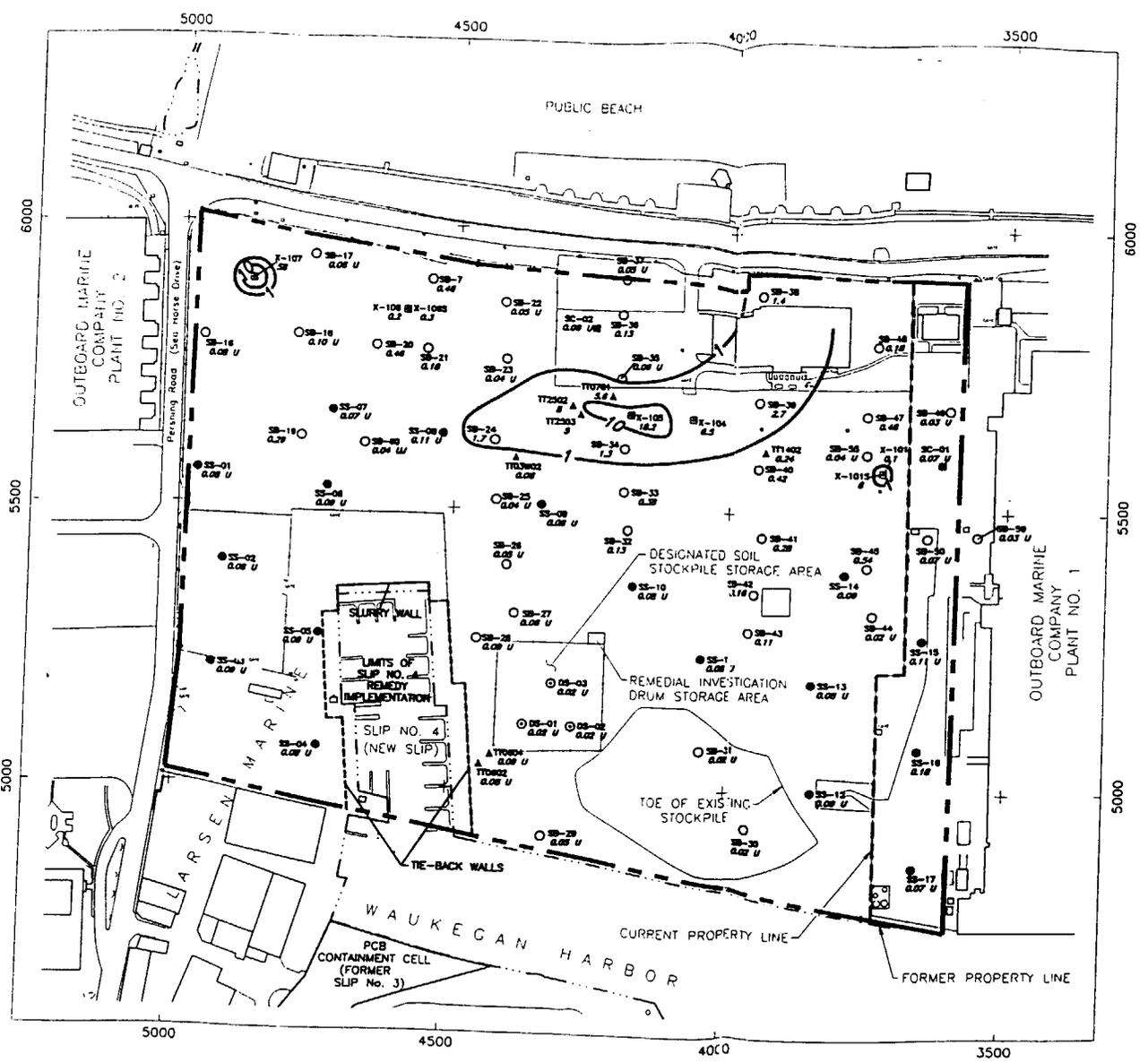
- SB-01 Designated Soil Stockpile Sample Location.
- X-108 Illinois Environmental Protection Agen Soil Sample Location
- ▲ TT0804 Test Trench Sample Location
- SB-33 Soil Boring Location
- 47 Cyanide Concentration (mg/kg)
- ND Not Detected
- 10— Cyanide Concentrations In Soil (Contours Are Approximate)

NOTE:  
 See Analytical Data Tables For Explanation Of Data Qualifiers.  
 Soil Stockpile Concentrations Are Located At Depths Below The Base Of The Soil Stockpile  
 Designated Soil Stockpile Concentrations Are From Within The Containment Cell And Are Excluded From Contouring.

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Figure 7.6-6  
 DISTRIBUTION OF CYANIDE  
 CONCENTRATIONS IN VADOSE ZONE SOILS  
 DEPTH 0.5'-4.5'  
 Waukegan Manufactured Gas & Coke Plant

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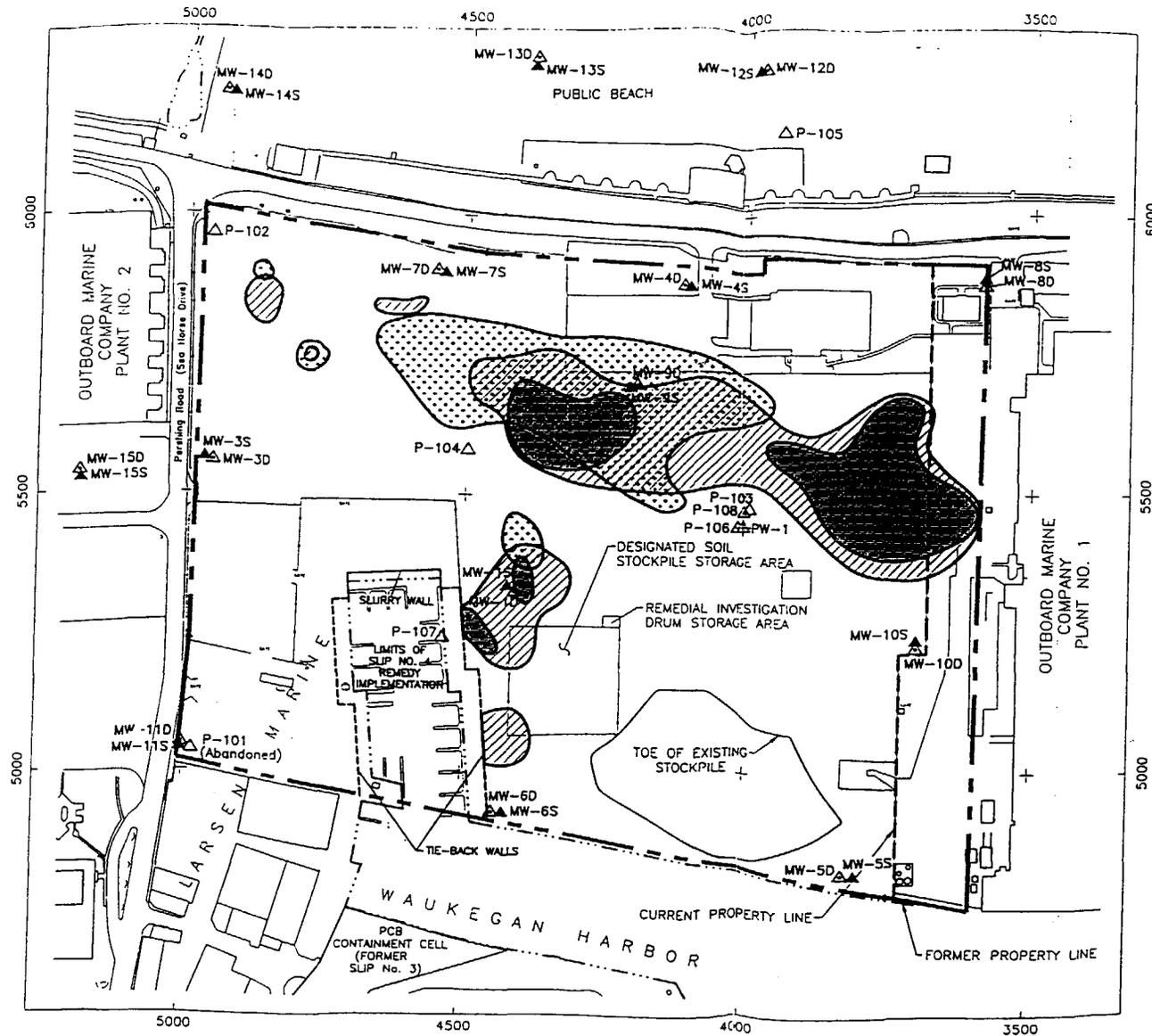


- SS-01 Designated Soil Stockpile Sample Location.
- ⊗ SX-106 Illinois Environmental Protection Agency Soil Sample Location
- SS-07 Surficial Soil Sample Location
- SC-01 Surficial Soil Sample Location
- ▲ TT2502 Test Trench Sample Location
- SS-33 Soil Boring Location
- 2.7 Mercury Concentration (mg/kg)
- ND Not Detected
- 10— Mercury Concentrations In Soil (Contours Are Approximate)

NOTE:  
 See Analytical Data Tables For Explanation Of Data Qualifiers.  
 Soil Stockpile Concentrations Are Located At Depths Below The Base Of The Soil Stockpile.  
 Designated Soil Stockpile Concentrations Are From Within The Containment Cell And Are Excluded From Contouring.

Figure 7.6-7  
 DISTRIBUTION OF MERCURY  
 CONCENTRATIONS IN VADOSE ZONE SOILS  
 DEPTH 0.5'-4.5'  
 Waukegan Manufactured Gas & Coke Plant

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- ▲ MW-75 Sand Aquifer Water Table Monitoring Well
- △ MW-7D Sand Aquifer Deep Monitoring Well
- ⊕ PW-1 Pumping Well
- △ P-107 Piezometer
- ▨ Arsenic - Above 84 mg/kg
- ▧ Total PAH's - Above 100 mg/kg
- Total PAH's - Above 2000 mg/kg

Shallow soils (0-5')

### POTENTIAL SOIL REMEDIATION Waukegan Manufactured Gas & Coke Plant

March 17, 1998

Mike Bellot  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 West Jackson Blvd.  
Chicago, Illinois 60604-3590

**RE: Sampling Plan Revision - OMC Waukegan Plant No. 1 Parking Lot Expansion**

Mr. Bellot,

Based on our conference call on March 9, 1998 and a follow up conversation on March 12, 1998 OMC has revised the upcoming soil sampling activities. In the above discussions the U.S. Environmental Protection Agency (USEPA) requested that OMC follow the Quality Assurance Project Plan (QAPP) and Sampling Analysis Plan (SAP) used for the MFG/Coke Plant Remedial Investigation (RI) for the proposed sampling plan. OMC proposes not to utilize the MFG/Plant QAPP but instead will follow the Illinois Environmental Protection Agency (IEPA) Analytical Quality Assurance Plan (AQAP) Level IIIB. However, OMC will follow the MFG/Coke Plant SAP to collect the proposed soil samples. Discussed below is the reason for the adopting the above procedures.

Upon review of Barr's QAPP it was determined that Contract Laboratory Program (CLP) methods were employed for most parameters of concern. Data collected at the MFG/Coke Plant using CLP methods were intended to be used for risk assessment purposes. CLP methods pose an undue burden for the purpose soil sampling activities for the following reasons:

- Turn around time for analytical result puts the project schedule well beyond the July 1, 1998 deadline,
- No significant data quality improvement is achieved
- Data is not intended to be used for a risk assessment
- most recent groundwater sampling at the MFG/Coke Plant did not employ CLP methods

The IEPA AQAP Level IIIB protocols are designed to satisfy data quality objectives for site characterizations, establish cleanup objectives, and to demonstrate closure. A copy of the IEPA AQAP dated April 1, 1996 (latest versions) is provided as an attachment. The specific methods that will be used to analyze the parameters of concern are presented in Table 1.

Soil sampling procedures will follow Barr's 1991RI work plan SAP. The procedures are presented out in Section \_\_\_\_\_ of the SAP.

The parking lot location is presented in Figure 1. The proposed sample locations are presented in

Figure 2 and are the same locations as those in the letter sent to you on March 6, 1998. Table 2 and Table 3 present the parameter list and sample collection key respectively.

The schedule for the planned parking lot extension that was sent to you on March 19, 1998 has been revised. The new completion date will be July 1, 1998. A revised schedule reflecting these changes will be forwarded to you in the next week.

If you have any additional question please contact us at (847) 689-5574.

Sincerely,

Lisa A. Bongiovanni  
Environmental Control Analyst



OMC BOARD MARINE CORPORATION

March 19, 1998

100 Sea Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 847/689-6200

Mike Bellot  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 West Jackson Blvd.  
Chicago, Illinois 60604-3590

**RE: Schedule & Sampling Plan Revisions - OMC Waukegan Plant No. 1 Parking Lot Expansion**

Mr. Bellot,

The schedule for the planned parking lot expansion that was sent to you via facsimile on March 19, 1998 has been revised. The new completion date will be July 1, 1998. A revised schedule reflecting these changes will be forwarded to you in the next week.

OMC has revised the upcoming soil sampling activities presented in our letter dated March 6, 1998 as a result of the conference call on March 9, 1998 and a follow up telephone conversation on March 12, 1998. In the above discussions the U.S. Environmental Protection Agency (USEPA) requested that OMC follow the Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) used for the MFG/Coke Plant Remedial Investigation (RI) for the proposed sampling activities.

In order to use newer analytical procedures than those outlined in the MFG/Plant QAPP, OMC will utilize the Illinois Environmental Protection Agency (IEPA) Analytical Quality Assurance Plan (AQAP) Level IIIB. A copy of the IEPA AQAP is provided in Attachment A. The IEPA AQAP is recommended for all state Site Remediation Program projects. The IEPA AQAP Level IIIB protocols are designed to satisfy data quality objectives for site characterizations, establish cleanup objectives, and demonstrate closure. The Level IIIB methodologies used by the laboratory can, if necessary, comply with Contract Laboratory Procedures (CLP) reporting guidelines. The specific methods that will be used to analyze the parameters of concern are presented in Table 1. The laboratory will employ the latest version of each analytical method performed.

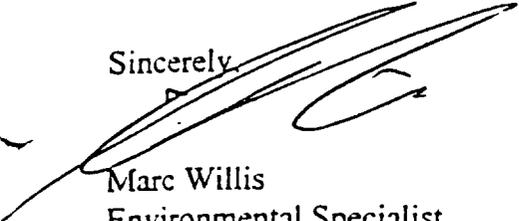
Soil sampling procedures will follow the MFG/Coke Plant 1991 RI FSP Attachment 1 "SOP for Soil Sample Collection." A copy of the MFG/Coke Plant FSP Attachment 1 is provided in Attachment B. Included in Attachment B is a letter to the USEPA from Barr Engineering outlining modifications to the FSP. These modifications will be employed as appropriate.

March 19, 1998  
Mr. Bellot  
Plant No. 1 Parking Lot Expansion  
Page 2

A site map is presented in Figure 1 and the sample locations are presented in Figure 2. These are the same locations as shown in the letter to you dated March 6, 1998. The analytical parameter list and sample collection key are summarized in Table 2 and 3 respectively.

In order to assure that the new deadline for the parking lot expansion is met OMC would like to begin the soil sampling activities as soon as possible. If you have any questions or comments please contact us at (847) 689-5574.

Sincerely,



Marc Willis  
Environmental Specialist

#### Attachments

cc: M. Cannon  
R. Crawford  
T. Elsen  
J. Moran  
S. Mulroney  
L. Bongiovanni

Table 1: Analytical Methods

Inorganic		Volatile Organic		Semivolatile Organic and Phenolic Compounds			
Compound	Method	Compound	Method	Compound	Method	Compound	Method
Arsenic	6010	Benzene	8260	Acenaphthene	8270	Flouranthene	8270
Cadmium	6010	Ethyl Benzene	8260	Acenaphthylene	8270	Fluorene	8270
Cyanide (tot.)	9014	Toluene	8260	Anthracene	8270	Indeno (1,2,3-cd) pyrene	8270
Lead	6010	Tot. Xylenes	8260	Benzo (a) Anthracene	8270	2-Methylnaphthalene	8270
Mercury	7470			Benzo (a) pyrene	8270	Naphthalene	8270
Selenium	6010			Benzo (b) fluoranthene	8270	Phenathrene	8270
				Benzo (ghi) perlene	8270	Pyrene	8270
				Benzo (k) flouranthene	8270	o-cresol	8270
				Carbazole	8270	p-cresol	8270
				Chrysene	8270	2,4-Dimethylphenol	8270
				Dibenzo (ah) anthracene	8270	Phenol	8270
				Dibenzofuran	8270		

Table 2  
 Parameter List (1)  
 For Parking Lot Expansion  
 Waukegan Plant No. 1  
 Waukegan Illinois

Inorganic Compounds	Volatile Organic Compounds	Semivolatile Organic Compounds		Phenolic Compounds
Arsenic (total) - 68108 Cadmium - 01015 Cyanide (total) 90105 Lead 00105 Mercury 74204 Selenium 00105	Benzene Ethyl benzene Toluene Total Xylenes (C10T)	Acenaphthene Acenaphthylene Anthracene Benzo (a) anthracene Benzo (a) pyrene Benzo (b) fluoranthene Benzo (ghi) perylene Benzo (k) fluoranthene Carbazole Chrysene	Dibenzo (ah) anthracene Dibenzofuran Fluoranthene Fluorene Indeno (1,2,3-cd) pyrene 2-Methylnaphthalene Naphthalene Phenathrene Pyrene	o-Cresol p-Cresol 2,4-Dimethylphenol Phenol

1) Parameter list is based on Phase II soil analyte list, Coke Plant Remedial Investigation

Table 3  
 Sample Collection Key  
 Parking Lot Expansion  
 Waukegan Plant No. 1  
 Waukegan, Illinois

Location	Depth ft (bgs)	Inorganic	VOCs	SVOCs	Phenolic Compounds
B-OMC-1	0 - 2 & 2 - 4	X	X	X	X
B-OMC-2	0 - 2 & 2 - 4	X	X	X	X
B-OMC-3	0 - 2	X	X	X	X
B-OMC-4	0 - 2	X	X	X	X
B-OMC-5	0 - 2	X	X	X	X
B-OMC-6	0 - 2	X	X	X	X
B-OMC-7	0 - 2	X	X	X	X
B-OMC-8	0 - 2	X	X	X	X



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○ Proposed surface & subsurface soil sample locations (1 to 2 ft. below ground surface bgs) & (2 to 4ft. bgs)

△ Proposed surface soil sample locations (1 to 2 ft. bgs)

□ Existing soil sampling locations

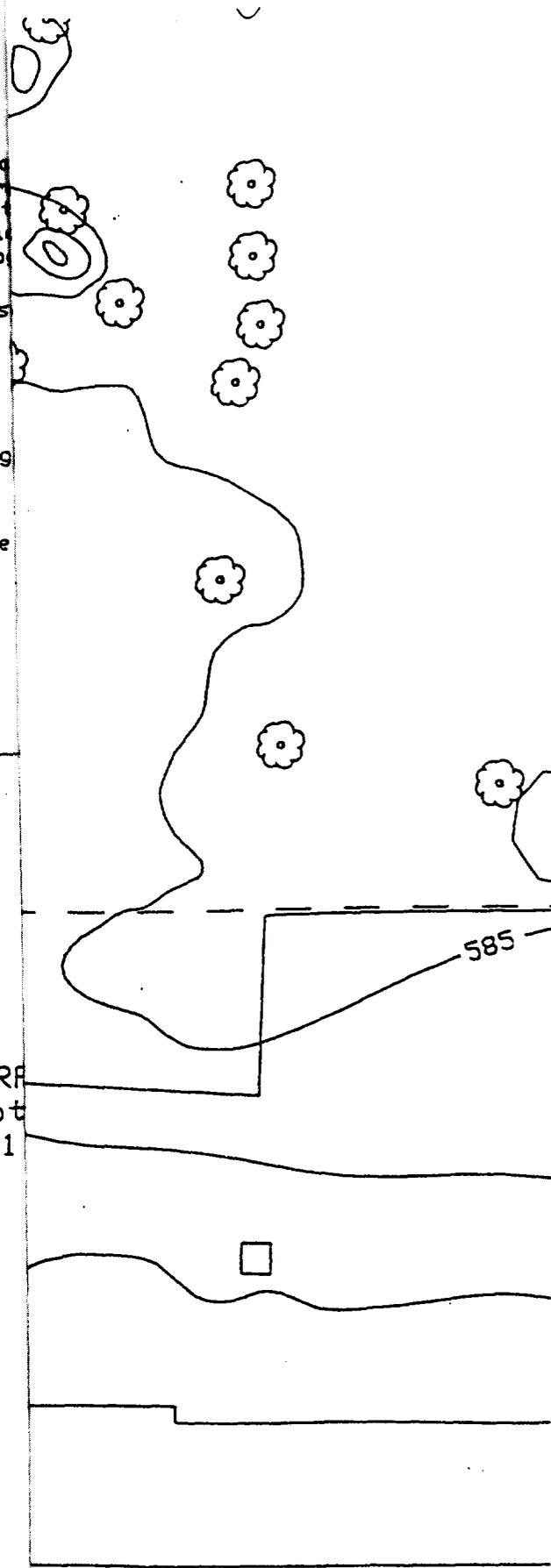
Sample locations are approximate

PROPOSED PARKING LOT

OUTBOARD MARINE CORP  
Proposed Parking Lot  
Waukegan Plant No. 1  
Waukegan, Illinois



1 Inch = 50 ft.



**Attachment A**

**Analytical Quality Assurance Plan**

**for the  
Illinois Environmental Protection Agency  
Bureau of Land  
Site Remediation Program**

**Revision 2**

**Prepared by:  
Illinois Environmental Protection Agency  
Division of Laboratories  
Quality Assurance Section  
April 1, 1996**

## INTRODUCTION

The Illinois Environmental Protection Agency's Bureau of Land Site Remediation Program (Program) has established data quality objectives and data quality assurance requirements applicable to all laboratory analytical data intended to support Program critical determinations and decisions. This document identifies the Program objectives and the minimum requirements for the generation of laboratory analytical data. This document does not address the generation of field analytical data, nor field quality assurance procedures.

All laboratory analytical data submitted to the Agency intended to support Program critical decisions and determinations must be scientifically valid, defensible, sufficiently documented, and of known precision, accuracy and completeness. Adherence to the Program data quality objectives and analytical quality assurance requirements identified in this document will minimize the generation of laboratory analytical data of a quality unacceptable to the Agency.

This document contains descriptions of the Program data quality objectives and the specific analytical methods, required quantitation limits, quality assurance / quality control (QA/QC) procedures, data documentation requirements, and data reporting requirements necessary to meet Program data quality objectives. Laboratory protocols for the preparation of sample containers, sample handling, sample storage, and sample chain-of-custody which meet Program data quality objectives are also included.

All QA/QC procedures identified in this document are in accordance with applicable professional technical standards, State of Illinois regulations and guidelines, Agency requirements, and specific Bureau of Land Site Remediation Program data quality objectives.

Persons requesting the Agency's review and evaluation services are responsible for validation and certification in accordance with this document of all laboratory analytical data submitted in support of Program critical decisions or determinations.

## TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
	TITLE PAGE	
	INTRODUCTION	
1.0	PROJECT DESCRIPTION	1-1
	1.1 Program Overview	1-1
	1.2 Site Specific Project Objectives	1-1
	1.3 Program Critical Decisions and Determinations	1-1
	1.4 Analytical Parameters for Categories of Decisions and Determinations	1-2
	1.5 Analytical Support	1-2
2.0	QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA	2-1
	2.1 Definitions of Precision and Accuracy for the Site Remediation Program	2-1
	2.2 Quality Control Procedures Used to Assess Precision and Accuracy	2-2
	2.3 Frequency of Quality Control Procedures and Objectives for Precision and Accuracy	2-2
	2.4 Representativeness, Completeness and Comparability	2-3
	2.5 Failure to Meet Agency Quality Assurance Objectives	2-3
3.0	SAMPLE CONTAINERS	3-1
	3.1 Sample Container and Component Material Guidelines	3-1
	3.2 Maximum Contaminant Level Specifications for Sample Containers	3-1
	3.3 Sample Container Preparation Cleaning Procedures	3-2
	3.4 Sample Container Quality Assurance and Quality Control Procedures	3-3
4.0	SAMPLE CUSTODY, PRESERVATION, AND HOLDING TIMES	4-1

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5.0	<b>ANALYTICAL PROCEDURES AND CALIBRATIONS</b>	5-1
5.1	Sample Preparation Procedures	5-1
5.2	Analytical Methods	5-2
5.3	Calibration Procedures and Frequencies	5-2
5.4	Standard Operating Procedures	5-3
6.0	<b>DATA REDUCTION, VALIDATION, AND REPORTING</b>	6-1
6.1	Laboratory Data Reduction	6-1
6.2	Laboratory Data Validation	6-1
6.3	Laboratory Data Reporting	6-2
7.0	<b>INTERNAL QUALITY CONTROL CHECKS</b>	7-1
7.1	Quality Control Checks	7-1
7.2	Organic Quality Control Check Analyses	7-2
7.3	Inorganic Quality Control Check Analyses	7-3
8.0	<b>PERFORMANCE AND SYSTEMS AUDITS</b>	8-1
8.1	Internal Audits	8-1
8.2	External Audits	8-1
9.0	<b>CALCULATIONS OF DATA QUALITY INDICATORS</b>	9-1
9.1	Precision	9-1
9.2	Accuracy	9-1
9.3	Completeness	9-2
9.4	Sensitivity	9-2
10.0	<b>CORRECTIVE ACTIONS</b>	10-1

**Appendix A Data Reporting Instructions and Forms**

## 1.0 PROGRAM DESCRIPTION

### 1.1 PROGRAM OVERVIEW

Site Remediation Site Cleanup Program (Program) projects generally are comprised of one or both of the following elements:

1. Site investigation conducted pursuant to an Agency approved Site Investigation Work Plan; and
2. Site remediation conducted pursuant to an Agency approved Site Remedial Action Work Plan.

### 1.2 SITE SPECIFIC PROJECT OBJECTIVES

The Program is reliant upon voluntary participation by a site owner or operator, or her or his express written designee (participant). Site specific project objectives are identified by the participant requesting the Agency's review and evaluation services and are not typically imposed by the Agency.

### 1.3 PROGRAM CRITICAL DECISIONS AND DETERMINATIONS

#### 1.3.1 Definitions of Categories of Critical Decisions and Determinations

In order to meet their project objectives, Program participants may request the Agency's review and evaluation of critical decisions and determinations. These decisions and determinations can be divided into two categories, which are identified as follows:

#### CATEGORY

- A. Identification of the classes of chemicals of concern and subsequent reduction of sampling and analytical requirements for site remedial response activities;
- B. Demonstration of the sufficiency of site characterizations, investigations and establishment of site cleanup objectives; and the demonstration of attainment of site cleanup objectives and specific project objectives.

#### 1.3.2 Analytical Support for Critical Decisions and Determinations

Initial site investigations to determine contaminants of concern for subsequent investigations and remediation require Category A determinations. For Category A determinations the laboratory analytical support must provide for detections of a large number of potential contaminants. However, quantitation limits of the analytical support for Category A determinations may not be sufficient to support Category B decisions and determinations.

Routine site investigations to determine the full nature and extent of site contamination and the demonstration of attainment of Agency-established cleanup objectives requires Category B decisions and determinations. For Category B determinations and decisions the laboratory analytical support will require sample analyses for either a reduced list of potential contaminants utilizing lower quantitation limits than those applied in initial investigations; or a list of known contaminants utilizing quantitation levels at or below the Agency-established cleanup objective concentrations.

#### 1.4 ANALYTICAL PARAMETERS FOR CATEGORIES OF DECISIONS AND DETERMINATIONS

##### 1.4.1 Category A

Tables 1-1 through 1-4 contain a list of the analytical parameters, their Required Quantitation Limits (RQLs), and the USEPA analytical method number, for use in the generation of data used for Category A decisions and determinations. Required Quantitation Limits for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the % solids in each sample.

##### 1.4.2 Category B

Tables 1-5 and 1-6 contain a list of analytical parameters, various Estimated Quantitation Limits (EQLs), and the USEPA analytical method number, for use in the generation of data used for Category B decisions and determinations. The participants Project Manager should consult with the Illinois EPA Project Manager to determine the exact list of parameters for Category B decisions and determinations and the EQLs acceptable for the Category B decisions and determinations. EQLs for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the % solids in each sample. The USEPA analytical method selected for use must have a EQL which meets or is lower than the Illinois EPA Clean-up Objectives.

#### 1.5 ANALYTICAL SUPPORT - LEVELS OF DATA QUALITY

The following definitions of data quality levels are provided for reference. ALL Site Remediation Program laboratory chemical analyses in support of both categories of decisions and determinations must be at Level III (see definition below) and meet the minimum requirements specified in this Analytical Quality Assurance Plan. For Category B decisions and determinations, the USEPA analytical method selected for use must have estimated quantitation limits which meets or is lower than the Agency-established Clean-up Objectives.

Level I - Screening: This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, initial site characterization to locate areas for subsequent and more accurate analyses, and for engineering screening of

alternatives (bench-scale tests). These types of data include those generated on-site through the use of HNu, pH, conductivity, and other real-time monitoring equipment at the site.

Level II - Field Analyses: This provides rapid results and better quality than in Level I. This level may include mobile lab generated data depending on the level of quality control exercised. The field analyses can provide data from the analyses of air, soil, sediment, and water for many organic and inorganic analytes.

Level III - Engineering: This provides an intermediate level of data quality designed to provide confirmed identification and quantification of organic and inorganic analytes in water, soil, and sediment media. Level III protocols all have built-in QA/QC including external QA in the form of trip blanks, replicate samples, and blind samples. Level III analytical methods and protocols are identified in Test Methods For Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition and subsequent Updates. Level III data is used for site characterization, confirmation of Level I and Level II field data, establishing cleanup objectives, and environmental monitoring to demonstrate attainment of cleanup objectives or compliance with applicable standards. Level III data should provide sufficient documentation to allow qualified personnel to review, evaluate and validate data quality in accordance with acknowledged standards and protocols.

Level IV - Confirmational: This provides the highest level of data quality and is used for purposes of risk assessment and evaluation of remedial alternatives. These analyses require full USEPA Contract Laboratory Program (CLP) analytical and data validation procedures in accordance with EPA recognized protocol. Level IV analyses are typically required for the conduct of CERCLA compliant and equivalent remedial response activities.

Level V - Non-Standard: This refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to Level IV data. The Illinois Environmental Protection Agency must be consulted for protocol approval before any non-standard methods may be utilized for Program sites. Level V poses limitations because of the amount of lead time for start up may be significant and analyses may be one-of-a-kind, resulting in a lack of comparability of the data.

Compound	Water ( $\mu\text{g/L}$ )	Low Soil ( $\mu\text{g/Kg}$ )	Med. Soil ( $\mu\text{g/Kg}$ )	Method
Chloromethane	10	10	1200	8260A
Bromomethane	10	10	1200	8260A
Vinyl Chloride	10	10	1200	8260A
Chloroethane	10	10	1200	8260A
Methylene Chloride	10	10	1200	8260A
Acetone	10	10	1200	8260A
Carbon Disulfide	10	10	1200	8260A
1,1-Dichloroethene	10	10	1200	8260A
1,1-Dichloroethane	10	10	1200	8260A
1,2-Dichloroethene (total)	10	10	1200	8260A
Chloroform	10	10	1200	8260A
1,2-Dichloroethane	10	10	1200	8260A
2-Butanone	10	10	1200	8260A
1,1,1-Trichloroethane	10	10	1200	8260A
Carbon Tetrachloride	10	10	1200	8260A
Bromodichloromethane	10	10	1200	8260A
1,2-Dichloropropane	10	10	1200	8260A
cis-1,3-Dichloropropene	10	10	1200	8260A
Trichloroethene	10	10	1200	8260A
Dibromochloromethane	10	10	1200	8260A
1,1,2-Trichloroethane	10	10	1200	8260A
Benzene	10	10	1200	8260A
trans-1,3-Dichloropropene	10	10	1200	8260A
Bromoform	10	10	1200	8260A
4-Methyl-2-pentanone	10	10	1200	8260A
2-Hexanone	10	10	1200	8260A
Tetrachloroethene	10	10	1200	8260A
Toluene	10	10	1200	8260A
1,1,2,2-Teterechloroethane	10	10	1200	8260A
Chlorobenzene	10	10	1200	8260A
Ethyle Benzene	10	10	1200	8260A
Styrene	10	10	1200	8260A
Xylenes (total)	10	10	1200	8260A

Required Quantitation Limits for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the percent dry weight in each sample.

See Section 1.4 for description of circumstances for the analyses of these compounds at these detection limits.

The laboratory shall report non surrogate components, tentatively identified by library search conducted per the guidelines contained in the analytical method.

Compound	Water ( $\mu\text{g/L}$ )	Low Soil ( $\mu\text{g/Kg}$ )	Med. Soil ( $\mu\text{g/Kg}$ )	Method
Phenol	10	660	10000	8270A
bis(2-Chloroethyl) ether	10	660	10000	8270A
2-Chlorophenol	10	660	10000	8270A
1,2-Dichlorobenzene	10	660	10000	8270A
1,3-Dichlorobenzene	10	660	10000	8270A
1,4-Dichlorobenzene	10	660	10000	8270A
2-Methylphenol	10	660	10000	8270A
2,2'-oxybis (1-chloropropane)	10	660	10000	8270A
4-Methylphenol	10	660	10000	8270A
N-Nitroso-di-n-propylamine	10	660	10000	8270A
Hexachloroethane	10	660	10000	8270A
Nitrobenzene	10	660	10000	8270A
Isophorone	10	660	10000	8270A
2-Nitrophenol	10	660	10000	8270A
2,4-Dimethylphenol	10	660	10000	8270A
bis(2-Chloroethoxy) methane	10	660	10000	8270A
2,4-Dichlorophenol	10	660	10000	8270A
1,2,4-Trichlorobenzene	10	660	10000	8270A
Naphthalene	10	660	10000	8270A
4-Chloroaniline	10	660	10000	8270A
Hexachlorobutadiene	10	660	10000	8270A
4-Chloro-3-methylphenol	10	660	10000	8270A
2-Methylnaphthalene	10	660	10000	8270A
Hexachlorocyclopentadiene	10	660	10000	8270A
2,4,6-Trichlorophenol	10	660	10000	8270A
2,4,5-Trichlorophenol	25	1600	25000	8270A
2-Chloronaphthalene	10	660	10000	8270A
2-Nitroaniline	25	1600	25000	8270A
Dimethylphthalate	10	660	10000	8270A
Acenaphthalene	10	660	10000	8270A
2,6-dinitrotoluene	10	660	10000	8270A
3-Nitroaniline	25	1600	25000	8270A
Acenaphthene	10	660	10000	8270A
2,4-Dinitrophenol	25	1600	25000	8270A
4-Nitrophenol	25	1600	25000	8270A

Required Quantitation Limits for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the % solids in each sample. This is based on a 30 gram sample and GPC cleanup

See Section 1.4 for description of circumstances for the analyses of these compounds at these detection limits.

The laboratory shall report non surrogate components, tentatively identified by library search, conducted per the guidelines contained in the analytical method.

Table 1-2 Semivolatile Organic Analytical Parameters and Required Quantitation Limits				
Compound	Water ( $\mu\text{g/L}$ )	Low Soil ( $\mu\text{g/Kg}$ )	Med. Soil ( $\mu\text{g/Kg}$ )	Method
Dibenzofuran	10	330	10000	8270A
2,4-Dinitrotoluene	10	330	10000	8270A
Diethylphthalate	10	330	10000	8270A
4-Chlorophenyl-phenyl ether	10	330	10000	8270A
Flourene	10	330	10000	8270A
4-Nitroaniline	25	1600	25000	8270A
4,6-Dinitro-2-methylphenol	25	1600	25000	8270A
N-nitrosodiphenylamine	10	330	10000	8270A
4-Bromophenyl-phenyl ether	10	330	10000	8270A
Hexachlorobenzene	10	330	10000	8270A
pentachlorophenol	25	1600	25000	8270A
Phenanthrene	10	660	10000	8270A
Anthracene	10	660	10000	8270A
Carbazole	10	660	10000	8270A
Di-n-butylphthalate	10	660	10000	8270A
Fluoranthene	10	660	10000	8270A
Pyrene	10	660	10000	8270A
Butylbenzylphthalate	10	660	10000	8270A
3,3'-Dichlorobenzidine	10	660	10000	8270A
Benzo(a)anthracene	10	660	10000	8270A
Chrysene	10	660	10000	8270A
bis(2-Ethylhexyl)phthalate	10	660	10000	8270A
Di-n-octylphthalate	10	660	10000	8270A
Benzo(b)fluoranthene	10	660	10000	8270A
Benzo(k)fluoranthene	10	660	10000	8270A
Benzo(a)pyrene	10	660	10000	8270A
Indeno(1,2,3-cd)pyrene	10	660	10000	8270A
Dibenz(a,h)anthracene	10	660	10000	8270A
Benzo(g,h,i)perylene	10	660	10000	8270A

Required Quantitation Limits for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the % solids in each sample. This is based on a 30 gram sample and GPC cleanup

See Section 1.4 for description of circumstances for the analyses of these compounds at these detection limits.

The laboratory shall report non surrogate components, tentatively identified by library search conducted per the guidelines contained in the analytical method.

Table 1-3 Pesticide and Aroclors Organic Analytical Parameters and Required Quantitation Limits			
Compound	Water ( $\mu\text{g/L}$ )	Low Soil ( $\mu\text{g/Kg}$ )	Method
alpha-BHC	0.05	8.0	8081
beta-BHC	0.05	8.0	8081
delta-BHC	0.05	8.0	8081
gamma-BHC	0.05	8.0	8081
Heptachlor	0.05	8.0	8081
Aldrin	0.05	8.0	8081
Heptachlor epoxide	0.05	8.0	8081
Endosulfan I	0.05	8.0	8081
Dieldrin	0.10	16.0	8081
4,4'-DDE	0.10	16.0	8081
Endrin	0.10	16.0	8081
Endosulfan II	0.10	16.0	8081
4,4'-DDD	0.10	16.0	8081
Endosulfan sulfate	0.10	16.0	8081
4,4'-DDT	0.10	16.0	8081
Methoxychlor	0.50	80.0	8081
Endrin ketone	0.10	16.0	8081
endrin aldehyde	0.10	16.0	8081
alpha-Chlordane	0.50	80.0	8081
gamma-Chlordane	0.50	80.0	8081
Toxaphene	1.0	160.0	8081
Aroclor - 1016	0.50	80.0	8081
Aroclor - 1221	0.50	80.0	8081
Aroclor - 1232	0.50	80.0	8081
Aroclor - 1242	0.50	80.0	8081
Aroclor - 1248	0.50	80.0	8081
Aroclor - 1254	1.0	160.0	8081
Aroclor - 1260	1.0	160.0	8081

Required Quantitation Limits for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the % solids in each sample.

See Section 1.4 for description of circumstances for the analyses of these compounds at these detection limits.

Table 1-4 Inorganic Analytical Parameters and Required Quantitation Limits			
Analyte	Water ( $\mu\text{g/L}$ )	Soil ( $\text{mg/Kg}$ )	Method
Aluminum	200	40	6010A
Antimony	60	12	6010A
Arsenic	10	2	7060A/7061A/ 7062
Barium	200	40	6010A
Beryllium	5	1	6010A
Cadmium	5	1	6010A
Calcium	5000	1000	6010A
Chromium	10	2	6010A
Cobalt	50	10	6010A
Copper	25	5	6010A
Iron	100	20	6010A
Lead	3	0.6	7421
Magnesium	5000	1000	6010A
Manganese	15	3	6010A
Mercury	0.2	0.04	7470A/7471A
Nickel	40	8	6010A
Potassium	5000	1000	6010A
Selenium	5	1	7740A/7741A/ 7742
Silver	10	2	6010A
Sodium	5000	1000	6010A
Thallium	10	2	7841
Vanadium	50	10	6010A
Zinc	20	4	6010A
Cyanide	10	2	9012

Required Quantitation Limits for soil are based on wet weight. Normally data is reported on a dry weight basis; therefore, Reporting Limits will be higher, based on the percent dry weight in each sample.

See Section 1.4 for description of appropriate circumstances for the analyses of these analytes at these detection limits.

Table 1-5 Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water ( $\mu\text{g/L}$ )	Soil ( $\mu\text{g/Kg}$ )
1,1-Dichloroethene	8240B	5.0	250.0
1,1,1,2-Tetrachloroethane	8021A	0.05	0.05
1,1,1,2-Tetrachloroethane	8260A	0.3	0.3
1,1,1,2-Tetrachloroethane	8240B	5.0	250.0
1,1,1,2-Tetrachloroethane	8010B	--	--
1,1,1-Trichloroethane	8021A	0.3	0.3
1,1,1-Trichloroethane	8010B	0.3	0.3
1,1,1-Trichloroethane	8260A	0.4	0.4
1,1,1-Trichloroethane	8240B	5.0	250.0
1,1,2,2-Tetrachloroethane	8021A	0.1	0.1
1,1,2,2-Tetrachloroethane	8260A	0.2	0.2
1,1,2,2-Tetrachloroethane	8010B	0.3	0.3
1,1,2,2-Tetrachloroethane	8240B	5.0	250.0
1,1,2-Trichloroethane	8010B	0.2	0.2
1,1,2-Trichloroethane	8260A	0.5	0.5
1,1,2-Trichloroethane	8240B	5.0	250.0
1,1,2-Trichloroethane	8021A	--	--
1,1-Dichloroethane	8260A	0.2	0.2
1,1-Dichloroethane	8010B	0.7	0.7
1,1-Dichloroethane	8021A	0.7	0.7
1,1-Dichloroethane	8240B	5.0	250.0
1,1-Dichloroethane	8260A	0.6	0.6
1,1-Dichloroethane	8021A	0.7	0.7
1,1-Dichloroethane	8010B	1.3	1.3
1,1-Dichloropropene	8021A	0.2	0.2
1,2,3,4-Tetrachlorobenzene	8121	0.11	7.37
1,2,3,5-Tetrachlorobenzene	8121	0.081	5.427
1,2,3-Trichlorobenzene	8121	0.39	26.13
1,2,3-Trichlorobenzene	8260A	0.2	0.2
1,2,3-Trichlorobenzene	8021A	0.3	0.3
1,2,3-Trichloropropane	8260A	1.6	1.6
1,2,3-Trichloropropane	8021A	4.0	4.0
1,2,3-Trichloropropane	8240B	5.0	250.0
1,2,3-Trichloropropane	8010B	--	--
1,2,4,5-Tetrachlorobenzene	8121	0.095	6.365
1,2,4,5-Tetrachlorobenzene	8270B	10.0	660.0
1,2,4,5-Tetrachlorobenzene	8250A	25.0	1650
1,2,4-Trichlorobenzene	8121	1.3	87.1
1,2,4-Trichlorobenzene	8260A	0.2	0.2
1,2,4-Trichlorobenzene	8021A	0.2	0.2
1,2,4-Trichlorobenzene	8120A	0.5	33.5
1,2,4-Trichlorobenzene	8270B	10.0	660.0
1,2,4-Trichlorobenzene	8250A	19	1273
1,2,4-Trimethylbenzene	8021A	0.5	0.5
1,2,4-Trimethylbenzene	8260A	0.7	0.7
1,2-Dibromo-3-Chloropropane	8021A	30.0	30.0
1,2-Dibromo-3-chloropropane	8240B	100.0	5000.0
1,2-Dibromoethane	8260A	0.3	0.3
1,2-Dibromoethane	8240B	5.0	250.0
1,2-Dibromoethane	8021A	8.0	8.0
1,2-Dichlorobenzene	8260	0.2	0.2
1,2-Dichlorobenzene	8021A	0.2	0.2
1,2-Dichlorobenzene	8121	2.7	180.9
1,2-Dichlorobenzene	8010B	1.5	1.5

Table 1-5 (page 2) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (µg/L)	Soil (µg/Kg)
1,2-Dichlorobenzene	8020B	4.0	4.0
1,2-Dichlorobenzene	8270B	10.0	660.0
1,2-Dichlorobenzene	8120A	11.4	763.8
1,2-Dichlorobenzene	8250A	19.0	1260
1,2-Dichloroethane	8010B	0.3	0.3
1,2-Dichloroethane	8021A	0.3	0.3
1,2-Dichloroethane	8260A	0.3	0.3
1,2-Dichloroethane	8240B	5.0	250.0
1,2-Dichloropropane	8021A	0.06	0.06
1,2-Dichloropropane	8260A	0.2	0.2
1,2-Dichloropropane	8010B	0.4	0.4
1,2-Dichloropropane	8240B	5.0	250.0
1,2-Dinitrobenzene	8270B	40.0	ND
1,2-Diphenylhydrazine	8250A	50	3300
1,3,5-Trichlorobenzene	8121	0.12	8.04
1,3,5-Trimethylbenzene	8021A	0.04	0.04
1,3,5-Trinitrobenzene	8270B	10.0	660.0
1,3-Dichlorobenzene	8021A	0.2	0.2
1,3-Dichlorobenzene	8121	2.5	167.5
1,3-Dichlorobenzene	8260A	0.6	0.6
1,3-Dichlorobenzene	8010B	3.2	3.2
1,3-Dichlorobenzene	8020B	4.0	4.0
1,3-Dichlorobenzene	8270B	10.0	660.0
1,3-Dichlorobenzene	8120A	11.9	797.3
1,3-Dichlorobenzene	8250A	19	1273
1,3-Dichloropropane	8260A	0.2	0.2
1,3-Dichloropropane	8021A	0.3	0.3
1,3-Dinitrobenzene	8270B	20.0	ND
1,4-Dichloro-2-butene	8240B	100.0	5000.0
1,4-Dichlorobenzene	8021A	0.07	0.07
1,4-Dichlorobenzene	8260A	0.2	0.2
1,4-Dichlorobenzene	8121	8.9	596.3
1,4-Dichlorobenzene	8010B	2.4	2.4
1,4-Dichlorobenzene	8020B	3.0	3.0
1,4-Dichlorobenzene	8270B	10.0	660.0
1,4-Dichlorobenzene	8120A	13.4	897.8
1,4-Dichlorobenzene	8250A	44	2948
1,4-Dichlorobenzene-d4 (I.S.)	8250A	44	2948
1,4-Dinitrobenzene	8270B	40.0	ND
1,4-Naphthoquinone	8270B	10.0	ND
1,4-Phenylenediamine	8270B	10.0	ND
1-Chlorohexane	8260A	0.3	0.3
1-Chloronaphthalene	8250A	50	3300
1-Naphthylamine	8270B	10.0	660
1-Naphthylamine	8250A	50	3300
2,2-Dichloropropane	8021A	0.5	0.5
2,2-Dichloropropane	8260A	1.8	1.8
2,3,4,6-Tetrachlorophenol	8270B	10.0	660
2,3,4,6-Tetrachlorophenol	8250A	50	3300
2,4,5-T	8151	0.08	0.3
2,4,5-T	8150B	2.0	40.0
2,4,5-TP	8151	0.075	0.28
2,4,5-TP (Silvex)	8150B	1.7	34.0

Table 1-5 (page 3) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
2,4,5-Trichlorophenol	8270B	10.0	660.0
2,4,5-Trichlorophenol	8250A	50	3300
2,4,5-Trimethylaniline	8270B	10.0	ND
2,4,6-Tribromophenol (surr.)	8250A	--	--
2,4,6-Trichlorophenol	8040A	6.4	428.8
2,4,6-Trichlorophenol	8270B	10.0	660.0
2,4,6-Trichlorophenol	8250A	27	1810
2,4-D	8151	0.2	0.11
2,4-D	8150B	12.0	240.0
2,4-DB	8150B	9.1	182.0
2,4-Diaminotoluene	8270B	20.0	ND
2,4-Dichlorophenol	8040A	3.9	261.3
2,4-Dichlorophenol	8270B	10.0	660.0
2,4-Dichlorophenol	8250A	27	1810
2,4-Dimethylphenol	8040A	3.2	214.4
2,4-Dimethylphenol	8270B	10.0	660.0
2,4-Dimethylphenol	8250A	27	1810
2,4-Dinitrophenol	8250A	42	2814
2,4-Dinitrophenol	8270B	50.0	3300.0
2,4-Dinitrophenol	8040A	130.0	8710.0
2,4-Dinitrotoluene	8090	0.2	13.4
2,4-Dinitrotoluene	8270B	10.0	660.0
2,4-Dinitrotoluene	8250A	57	3819
2,6-Dichlorophenol	8270B	10.0	ND
2,6-Dichlorophenol	8250A	50.0	3300
2,6-Dichlorophenol	8040A	--	--
2,6-Dinitrotoluene	8090	0.1	6.7
2,6-Dinitrotoluene	8270B	10.0	660.0
2,6-Dinitrotoluene	8250A	19	1273
2-Acetylaminofluorene	8270B	20.0	ND
2-Aminoanthraquinone	8270B	20.0	ND
2-Butanone	8240B	100.0	5000.0
2-Chloroethyl vinyl ether	8010B	1.3	1.3
2-Chloroethyl vinyl ether	8240B	10.0	500.0
2-Chloronaphthalene	8121	13.	871
2-Chloronaphthalene	8120A	9.4	629.8
2-Chloronaphthalene	8270B	10.0	660.0
2-Chloronaphthalene	8250A	19	1273
2-Chlorophenol	8040A	3.1	207.7
2-Chlorophenol	8270B	10.0	660.0
2-Chlorophenol	8250A	33	2211
2-Chlorotoluene	8021A	0.1	0.1
2-Chlorotoluene	8260A	0.2	0.2
2-Cyclohexyl-4,6-dinitrophenol	8270B	100.0	ND
2-Cyclohexyl-4,6-dinitrophenol	8040A	--	--
2-Fluorobiphenyl (surr.)	8250A	--	--
2-Fluorophenol (surr.)	8250A	--	--
2-Hexanone	8240B	50.0	2500.0
2-Methyl-4,6-dinitrophenol	8040A	160.0	10720.0
2-Methylnaphthalene	8270B	10.0	660.0
2-Methylnaphthalene	8250A	25	1650
2-Methylphenol	8270B	10.0	660.0
2-Methylphenol	8250A	25	1650
2-Naphthylamine	8270B	10.0	ND
2-Naphthylamine	8250A	25	1650
2-Nitroaniline	8270B	50.0	3300.0

Table 1-5 (page 4) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
2-Nitroaniline	8250A	50	3300
2-Nitrophenol	8040A	4.5	301.5
2-Nitrophenol	8270B	10.0	660.0
2-Nitrophenol	8250A	36	2412
2-Picoline	8250A	--	--
2-Picoline	8270B	ND	ND
2-sec-Butyl-4,6-dinitrophenol	8040A	--	--
2,4-DB	8151	0.8	
3,3'-Dichlorobenzidine	8270B	20.0	1300.0
3,3'-Dichlorobenzidine	8250A	165	1155
3,3'-Dimethoxybenzidine	8270B	100.0	ND
3,3'-Dimethylbenzidine	8270B	10.0	ND
3,5-Dichlorobenzoic acid	8151	0.061	0.38
3-(Chloromethyl)pyridine hydrochloride	8270B	100.0	ND
3-Hydroxycarbofuran	8318	2.6	10
3-Methylcholanthrene	8270B	10.0	660
3-Methylcholanthrene	8250A	50	3300
3-Methylphenol	8270B	10.0	660
3-Nitroaniline	8270B	50.0	3300.0
3-Nitroaniline	8250A	50.0	3300
4,4'-DDD	8081	0.05	4.2
4,4'-DDD	8080B	0.11	7.4
4,4'-DDD	8250A	28	1876
4,4'-DDE	8080B	0.04	2.7
4,4'-DDE	8081	0.058	2.5
4,4'-DDE	8250A	56	3752
4,4'-DDT	8081	0.081	3.6
4,4'-DDT	8080B	0.12	8.0
4,4'-DDT	8250A	47	3149
4,4'-Methoxychlor	8081	0.086	5.7
4,4'-Methylenebis(2-chloroaniline)	8270B	NA	ND
4,4'-Oxydianiline	8270B	20.0	ND
4,6-Dinitro-2-methylphenol	8250A	24	1608
4,6-Dinitro-2-methylphenol	8270B	50.0	3300.0
4-Aminobiphenyl	8270B	20.0	1320
4-Aminobiphenyl	8250A	50.0	3300
4-Bromophenyl phenyl ether	8110	23	1500
4-Bromophenyl phenyl ether	8250A	19	1273
4-Chloro-3-methylphenol	8250A	50.0	3300
4-Chloro-3-methylphenol	8040A	3.6	241.2
4-Chloro-3-methylphenol	8270B	20.0	1300.0
4-Chloroaniline	8270B	20.0	1300.0
4-Chloroaniline	8250A	50.0	3300
4-Chlorophenyl phenyl ether	8110	39	2600
4-Chlorophenyl phenyl ether	8270B	10.0	660.0
4-Chlorophenyl phenyl ether	8250A	42	2814
4-Chlorotoluene	8021A	0.1	0.1
4-Chlorotoluene	8260A	0.3	0.3
4-Methyl-2-pentanone	8240B	50.0	2500.0
4-Methylphenol	8270B	10.0	660.0
4-Methylphenol	8250A	50.0	3300
4-Nitroaniline	8270B	20.0	1320
4-Nitroaniline	8250A	50.0	3300
4-Nitrobiphenyl	8270B	10.0	ND
4-Nitrophenol	8151	0.13	0.34
4-Nitrophenol	8250A	24	1590

Table 1-5 (page 5) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
4-Nitrophenol	8040A	28.0	1876.0
4-Nitrophenol	8270B	50.0	3300.0
4-Nitroquinoline-1-oxide	8270B	40.0	ND
4-bromophenyl phenyl ether	8270B	10.0	660.0
5,5-Diphenylhydantoin	8270B	20.0	ND
5-Chloro-2-methylaniline	8270B	10.0	ND
5-Hydroxydicamba	8151	0.04	
5-Nitro-o-anisidine	8270B	10.0	ND
5-Nitro-o-toluidine	8270B	10.0	ND
5-Nitroacenaphthene	8270B	10.0	ND
7,12-Dimethylbenz(a)anthracene	8270B	10.0	ND
7,12-Dimethylbenz(a)anthracene	8250A	50.0	3300
Acenaphthene	8270B	10.0	660.0
Acenaphthene	8310	18.0	1206.0
Acenaphthene	8250A	19	1273
Acenaphthene-d10 (I.S.)	8250A	-	-
Acenaphthylene	8270B	10.0	660.0
Acenaphthylene	8310	23.0	1541.0
Acenaphthylene	8250A	35	2345
Acetaldehyde	8315	171	
Acetone	8240B	100.0	5000.0
Acetonitrile	8240B	100.0	5000.0
Acetophenone	8270B	10.0	ND
Acetophenone	8250A	50.0	3300
Acifluorfen	8151	0.96	
Acrolein	8030A	7.0	7.0
Acrolein (Propenal)	8316	30	
Acrylamide	8032	0.032	-
Acrylamide	8316	10	
Acrylonitrile	8030A	5.0	5.0
Acrylonitrile	8316	20	
Acrylonitrile	8031	10.0	-
Aldicarb (Temik)	8318	9.4	12
Aldicarb Sulfone	8318	1.9	44
Aldrin	8081	0.034	2.2
Aldrin	8080B	0.04	2.7
Aldrin	8250A	19	1273
Allyl chloride	8240B	5.0	250.0
Aminoazobenzene	8270B	10.0	ND
Anilazine	8270B	100.0	ND
Aniline	8250A	-	-
Anthracene	8310	6.6	442.2
Anthracene	8270B	10.0	660.0
Anthracene	8250A	19	1273
Aramite	8270B	20.0	ND
Aroclor-1016	8081	0.054	57
Aroclor-1016	8250A	-	-
Aroclor-1016	8080B	0.5	80
Aroclor-1221	8081	-	-
Aroclor-1221	8080B	0.5	80
Aroclor-1221	8250A	3	21
Aroclor-1232	8081	-	-
Aroclor-1232	8080B	0.5	80
Aroclor-1232	8250A	-	-
Aroclor-1242	8080B	0.5	43.6
Aroclor-1242	8081	-	-
Aroclor-1242	8250A	-	-

Table 1-5 (page 6) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
Aroclor-1248	8081	--	--
Aroclor-1248	8080B	0.5	80
Aroclor-1248	8250A	--	--
Aroclor-1254	8080B	1	160
Aroclor-1254	8081	--	--
Aroclor-1254	8250A	36	2412
Aroclor-1260	8081	0.9	70
Aroclor-1260	8080B	1	160
Aroclor-1260	8250A	--	--
Azinphos methyl	8141A	1.0	50.0
Azinphos methyl	8140	15.0	1005.0
Azinphos-methyl	8270B	100.0	ND
Barban	8270B	200.0	ND
Bentazon	8151	0.2	
Benz(a)anthracene	8270B	10.0	660.0
Benzal chloride	8121	0.05	3.35
Benzene	8021A	0.09	0.09
Benzene	8260A	0.2	0.2
Benzene	8020B	2.0	2.0
Benzene	8240B	5.0	250.0
Benzidinea	8250A	44	2948
Benzo(a)anthracene	8310	0.1	8.7
Benzo(a)anthracene	8250A	78	5226
Benzo(a)pyrene	8310	0.2	15.4
Benzo(a)pyrene	8270B	10.0	660.0
Benzo(a)pyrene	8250A	25	1675
Benzo(b)fluoranthene	8310	0.2	12.1
Benzo(b)fluoranthene	8270B	10.0	660.0
Benzo(b)fluoranthene	8250A	48	3216
Benzo(g,h,i)perylene	8270B	10.0	660.0
Benzo(g,h,i)perylene	8250A	41	2747
Benzo(ghi)perylene	8310	0.8	50.9
Benzo(k)fluoranthene	8310	0.2	11.4
Benzo(k)fluoranthene	8270B	10.0	660.0
Benzo(k)fluoranthene	8250A	25	1675
Benzoic acid	8270B	50.0	3300.0
Benzoic acid	8250A	--	--
Benzotrichloride	8121	0.06	4.02
Benzyl Chloride	8010B	--	--
Benzyl alcohol	8270B	20.0	1300.0
Benzyl alcohol	8250A	--	--
Benzyl benzoate	8061	--	--
Benzyl butyl phthalate	8060	3.4	227.8
Benzyl chloride	8121	1.8	120.6
Benzyl chloride	8240B	100.0	5000.0
Bis(2-chloroethoxy) methane	8110	5	335
Bis(2-chloroethoxy)methane	8270B	10.0	660.0
Bis(2-chloroethoxy)methane	8250A	53	3551
Bis(2-chloroethyl) ether	8110	3.0	200
Bis(2-chloroethyl) ether	8270B	10.0	660.0
Bis(2-chloroethyl) ether	8250A	57	3819
Bis(2-chloroisopropyl) ether	8110	8.0	530
Bis(2-chloroisopropyl) ether	8270B	10.0	660.0
Bis(2-chloroisopropyl) ether	8250A	57	3819
Bis(2-ethoxyethyl) phthalate	8061	2.7	180.9

Table 1-5 (page 7) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (µg/l)	Soil (µg/Kg)
Bis(2-ethylhexyl) phthalate	8061	2.7	180.9
Bis(2-ethylhexyl) phthalate	8270B	10.0	660.0
Bis(2-ethylhexyl) phthalate	8060	20.0	1340.0
Bis(2-ethylhexyl) phthalate	8250A	25	1675
Bis(2-methoxyethyl) phthalate	8061	5.1	341.7
Bis(2-n-butoxyethyl) phthalate	8061	0.34	56.28
Bis(4-methyl-2-pentyl) phthalate	8061	3.7	247.9
Bolstar	8140	1.5	100.5
Bolstar (Sulprofos)	8141A	0.7	35.0
Bromobenzene	8021A	0.06	0.06
Bromobenzene	8260A	0.2	0.2
Bromobenzene	8010B	--	--
Bromochloromethane	8021A	0.1	0.1
Bromochloromethane	8260A	0.2	0.2
Bromodichloromethane	8021A	0.2	0.2
Bromodichloromethane	8260A	0.4	0.4
Bromodichloromethane	8010B	1.0	1.0
Bromodichloromethane	8240B	5.0	250.0
Bromoform	8260A	0.6	0.6
Bromoform	8010B	2.0	2.0
Bromoform	8240B	5.0	250.0
Bromoform	8021A	16.0	16.0
Bromomethane	8260A	0.6	0.6
Bromomethane	8010B	3.0	3.0
Bromomethane	8240B	10.0	500.0
Bromomethane	8021A	11.0	11.0
Bromoxynil	8270B	10.0	ND
Butyl benzyl phthalate	8061	0.42	28.14
Butyl benzyl phthalate	8270B	10.0	660.0
Butyl benzyl phthalate	8250A	25	1675
Captafol	8270B	20.0	ND
Captan	8270B	50.0	ND
Carbaryl	8270B	10.0	ND
Carbaryl (Sevin)	8318	1.7	31
Carbofuran	8270B	10.0	ND
Carbofuran (Furadan)	8318	2	22
Carbon Tetrachloride	8021A	0.1	0.1
Carbon disulfide	8240B	100.0	5000.0
Carbon tetrachloride	8260A	1.1	1.1
Carbon tetrachloride	8010B	1.2	1.2
Carbon tetrachloride	8240B	5.0	250.0
Carbophenothion	8270B	10.0	ND
Chloramben	8151	0.093	4
Chlordane	8250A	--	--
Chlordane (technical)	8080B	0.1	9.4
Chlorfenviaphos	8270B	20.0	ND
Chlorobenzene	8021A	0.03	0.03
Chlorobenzene	8260A	0.2	0.2
Chlorobenzene	8020B	2.0	2.0
Chlorobenzene	8010B	2.5	2.5
Chlorobenzene	8240B	5.0	250.0
Chlorobenzilate	8270B	10.0	ND
Chlorodibromomethane	8240B	5.0	250.0
Chloroethane	8260A	0.5	0.5
Chloroethane	8021A	1.0	1.0
Chloroethane	8010B	5.2	5.2
Chloroethane	8240B	10.0	500.0
Chloroform	8260A	0.2	0.2

Table 1-5 (page 8) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
Chloroform	8021A	0.2	0.2
Chloroform	8010B	0.5	0.5
Chloroform	8240B	5.0	250.0
Chloromethane	8021A	0.3	0.3
Chloromethane	8260A	0.7	0.7
Chloromethane	8010B	0.8	0.8
Chloromethane	8240B	10.0	500.0
Chloroprene	8240B	5.0	250.0
Chlorpyrifos	8141A	0.7	50.0
Chlorpyrifos	8140	3.0	201.0
Chrysene	8310	1.5	100.5
Chrysene	8270B	10.0	660.0
Chrysene	8250A	25	1675
Chrysene-d12 (I.S.)	8250A	-	-
Coumaphos	8141A	2.0	100.0
Coumaphos	8140	15.0	1005.0
Coumaphos	8270B	40.0	ND
Cresols (methyl phenol)	8040A	-	-
Crotoxyphos	8270B	20.0	ND
DBCP	8011	0.1	-
DCPA diacid	8151	0.02	-
Dalapon	8151	1.3	0.12
Dalapon	8150B	58.0	1160.0
Demeton, O, S	8141A	1.2	60.0
Demeton-O	8140	2.5	167.5
Demeton-S	8140	2.5	167.5
Demeton-o	8270B	10.0	ND
Demeton-s	8270B	10.0	ND
Di-n-butyl phthalate	8061	3.3	221.1
Di-n-butyl phthalate	8060	3.6	241.2
Di-n-butyl phthalate	8270B	10.0	ND
Di-n-butylphthalate	8250A	25	1675
Di-n-octyl phthalate	8061	0.49	32.83
Di-n-octyl phthalate	8270B	10.0	660.0
Di-n-octyl phthalate	8060	30.0	2010.0
Di-n-octylphthalate	8250A	25	1675
Diallate (cis or trans)	8270B	10.0	ND
Diallate (trans or cis)	8270B	10.0	ND
Diarnyl phthalate	8061	1.1	73.7
Diazinon	8141A	2.0	100.0
Diazinon	8140	6.0	402.0
Dibenz(a,h)anthracene	8270B	10.0	660.0
Dibenz(a,h)anthracene	8250A	25	1675
Dibenz(a,j)acridine	8270B	10.0	ND
Dibenz(a,j)acridine	8250A	-	-
Dibenzo(a,e)pyrene	8270B	10.0	ND
Dibenzo(a,h)anthracene	8310	0.3	20.1
Dibenzofuran	8270B	10.0	660.0
Dibenzofuran	8250A	-	-
Dibromochloromethane	8260A	0.3	0.3
Dibromochloromethane	8021A	0.3	0.3
Dibromochloromethane	8010B	0.9	0.9
Dibromomethane	8260A	1.2	1.2
Dibromomethane	8240B	5.0	250.0
Dibromomethane	8021A	22.0	22.0
Dibromomethane	8010B	-	-
Dicamba	8151	0.081	-
Dicamba	8150B	2.7	54.0

Table 1-5 (page 9) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
Dichlone	8270B	--	ND
Dichlorodifluoromethane	8021A	0.5	0.5
Dichlorodifluoromethane	8250A	0.5	0.5
Dichlorodifluoromethane	8240B	5.0	250.0
Dichlorodifluoromethane	8010B	--	--
Dichloromethane	8010B	--	--
Dichloroprop	8150B	6.5	130.0
Dichlorovos	8270B	10.0	ND
Dichloroprop	8151	0.26	
Dichlorvos	8140	1.0	67.0
Dichlorvos	8141A	8.0	400.0
Dicrotophos	8270B	10.0	ND
Dicyclohexyl phthalate	8061	0.22	14.74
Dieldrin	8080B	0.02	1.3
Dieldrin	8081	0.044	--
Dieldrin	8250A	25	1675
Diethyl ether	8015A	--	--
Diethyl phthalate	8061	2.5	167.5
Diethyl phthalate	8060	4.9	328.3
Diethyl phthalate	8270B	10.0	660.0
Diethyl sulfate	8270B	100.0	ND
Diethylphthalate	8250A	19	1273
Diethylstilbestrol	8270B	20.0	ND
Diethyl phthalate	8061	0.68	45.56
Diisobutyl phthalate	8061	1.2	80.4
Dimethoate	8141A	2.6	130.0
Dimethoate	8270B	20.0	ND
Dimethyl phthalate	8060	2.9	194.3
Dimethyl phthalate	8061	6.4	428.8
Dimethyl phthalate	8270B	10.0	660.0
Dimethylaminoazobenzene	8270B	10.0	ND
Dimethylphthalate	8250A	16	172
Dinitrobenzene	8090	--	--
Dinocap	8270B	100.0	ND
Dinonyl phthalate	8061	0.22	14.74
Dinoseb	8151	0.19	
Dinoseb	8150B	0.7	14.0
Dinoseb	8270B	20.0	ND
Dioxacarb	8318	2.2	>50
Diphenylamine	8250A	--	--
Disulfoton	8141A	0.7	35.0
Disulfoton	8140	2.0	134.0
Disulfoton	8270B	10.0	ND
EDB	8011	0.1	--
EPN	8141A	0.4	20.0
EPN	8270B	10.0	ND
Endosulfan I	8081	0.03	2.1
Endosulfan I	8080B	0.14	9.4
Endosulfan I	8250A	--	--
Endosulfan II	8081	0.04	2.4
Endosulfan II	8080B	0.04	2.7
Endosulfan II	8250A	--	--
Endosulfan Sulfate	8081	0.035	3.6
Endosulfan sulfate	8080B	0.7	44.2
Endosulfan sulfate	8250A	56	3752
Endrin	8081	0.039	3.6
Endrin	8080B	0.06	4.0
Endrin	8250A	--	--

Table 1-5 (page 10) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (µg/L)	Soil (µg/Kg)
Endrin aldehyde	8081	0.05	1.6
Endrin aldehyde	8080B	0.2	15.4
Endrin aldehyde	8250A	-	-
Endrin ketone	8250A	-	-
Ethanol	8015A	-	-
Ethion	8270B	10.0	ND
Ethoosop	8141A	2.0	100.0
Ethoprop	8140	2.5	167.5
Ethyl Benzene	8020B	2.0	2.0
Ethyl carbamate	8270B	50.0	ND
Ethyl methacrylate	8240B	5.0	250.0
Ethyl methanesulfonate	8270B	20.0	ND
Ethyl methanesulfonate	8250A	-	-
Ethylbenzene	8021A	0.05	0.05
Ethylbenzene	8260A	0.3	0.3
Ethylbenzene	8240B	5.0	250.0
Famphur	8270B	20.0	ND
Fensulfothion	8141A	0.8	40.0
Fensulfothion	8140	15.0	1005.0
Fensulfothion	8270B	40.0	ND
Fenthion	8141A	0.8	50.0
Fenthion	8140	1.0	67.0
Fenthion	8270B	10.0	ND
Fluchloralin	8270B	20.0	ND
Fluoranthene	8270B	10.0	660.0
Fluoranthene	8250A	22	1474
Fluoranthrene	8310	2.1	140.7
Fluorene	8310	2.1	140.7
Fluorene	8270B	10.0	660.0
Fluorene	8250A	-	-
Formaldehyde	8315	7.2	-
Heptachlor	8080B	0.03	2.0
Heptachlor	8081	0.04	2
Heptachlor	8250A	19	1273
Heptachlor epoxide	8081	0.032	2.1
Heptachlor epoxide	8080B	0.8	55.6
Heptachlor epoxide	8250A	22	1474
Hexachlorobenzene	8121	0.056	3.752
Hexachlorobenzene	8120A	0.5	33.5
Hexachlorobenzene	8270B	10.0	660.0
Hexachlorobenzene	8250A	19	1273
Hexachlorobutadiene	8121	0.014	0.938
Hexachlorobutadiene	8021A	0.2	0.2
Hexachlorobutadiene	8260A	0.6	0.6
Hexachlorobutadiene	8120A	3.4	227.8
Hexachlorobutadiene	8250A	9	63
Hexachlorobutadiene	8270B	10.0	660.0
Hexachlorocyclohexane	8120A	-	-
Hexachlorocyclopentadiene	8121	2.4	160.8
Hexachlorocyclopentadiene	8120A	4	268
Hexachlorocyclopentadiene	8270B	10.0	660.0
Hexachlorocyclopentadiene	8250A	-	-
Hexachloroethane	8121	0.016	1.072
Hexachloroethane	8120A	0.3	20.1

Table 1-5 (page 11) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water ( $\mu\text{g/L}$ )	Soil ( $\mu\text{g/Kg}$ )
Hexachloroethane	8270B	10.0	660.0
Hexachloroethane	8250A	16	172
Hexachlorophene	8270B	50.0	ND
Hexachloropropene	8270B	10.0	ND
Hexamethyl phosphoramide	8270B	20.0	ND
Hexyl 2-ethylhexyl phthalate	8061	1.3	87.1
Hydroquinone	8270B	ND	ND
1,1-Dichloroethene	8260A	0.5	0.5
1-Acetyl-2-thiourea	8270B	1000.0	ND
Indeno(1,2,3-cd)pyrene	8310	0.4	28.8
Indeno(1,2,3-cd)pyrene	8270B	10.0	660.0
Indeno(1,2,3-cd)pyrene	8250A	37	2479
Isobutyl alcohol	8240B	100.0	5000.0
Isodrin	8270B	20.0	ND
Isophorone	8270B	10.0	660.0
Isophorone	8250A	22	1474
Isophorone	8090	157.0	10519.0
Isopropylbenzene	8021A	0.5	0.5
Isopropylbenzene	8260A	0.8	0.8
Isosafrole	8270B	10.0	ND
Keponc	8270B	20.0	ND
Leptophos	8270B	10.0	ND
MCPA	8151	0.056	43
MCPA	8150B	2490.0	49800.0
MCPP	8151	0.09	66
MCPP	8150B	1920.0	38400.0
Malathion	8141A	1.1	55.0
Malathion	8270B	50.0	ND
Maleic anhydride	8270B	NA	ND
Merphos	8141A	2.0	100.0
Merphos	8140	2.5	167.5
Mestranol	8270B	20.0	ND
Methacrylonitrile	8240B	100.0	5000.0
Methapyrilene	8270B	100.0	ND
Methiocarb (Mesuro)	8318	3.1	32
Methomyl (Lannate)	8318	1.7	12
Methoxychlor	8080B	1.8	117.9
Methoxychlor	8270B	10.0	ND
Methoxychlor	8250A	--	--
Methyl ethyl ketone (MEK)	8015A	--	--
Methyl iodide	8240B	5.0	250.0
Methyl isobutyl ketone (MIBK)	8015A	--	--
Methyl methacrylate	8240B	5.0	2500.0
Methyl methanesulfonate	8270B	10.0	ND
Methyl methanesulfonate	8250A	--	--
Methyl parathion	8270B	10.0	ND
Methylene Chloride	8021A	0.2	0.2
Methylene chloride	8260A	0.2	0.2
Methylene chloride	8240B	5.0	250.0
Mevinphos	8140	3.0	201.0
Mevinphos	8141A	5.0	250.0
Mevinphos	8270B	10.0	ND
Mexacarbate	8270B	20.0	ND
Mirex	8270B	10.0	ND
Monocrotophos	8270B	40.0	ND
N-Nitroso-di-N-propylamine	8250A	--	--
N-Nitroso-di-n-butylamine	8250A	--	--

Table 1-5 (page 12) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/l)	Soil (ug/kg)
N-Nitroso-di-n-propylamine	8270B	10.0	660.0
N-Nitrosodi-n-propylamine	8070	4.6	308.2
N-Nitrosodibutylamine	8270H	10.0	ND
N-Nitrosodiethylamine	8270B	20.0	ND
N-Nitrosodimethylamine	8070	1.5	100.5
N-Nitrosodimethylamine	8250A	-	-
N-Nitrosodiphenylamine	8070	8.1	542.7
N-Nitrosodiphenylamine	8270B	10.0	660.0
N-Nitrosodiphenylamine	8250A	19	1273
N-Nitrosopiperidine	8270B	20.0	ND
N-Nitrosopiperidine	8250A	-	-
N-Nitrosopyrrolidine	8270B	40.0	ND
Naled	8140	1.0	67.0
Naled	8141A	5.0	250.0
Naled	8270B	20.0	ND
Naphthalene	8260A	0.2	0.2
Naphthalene	8021A	0.6	0.6
Naphthalene	8270B	10.0	660.0
Naphthalene	8250A	16	172
Naphthalene	8310	18.0	1206.0
Naphthalene-d8 (I.S.)	8250A	-	-
Naphthoquinone	8090	-	-
Nicotine	8270B	20.0	ND
Nitrobenzene	8270B	10.0	660.0
Nitrobenzene	8250A	19	1273
Nitrobenzene	8090	137.0	9179.0
Nitrobenzene-d5 (surr.)	8250A	-	-
Nitrofen	8270B	20.0	ND
O,O,O-Triethylphosphorothioate	8270B	NT	ND
OCDD	8280		
Octamethyl pyrophosphoramidate	8270B	200.0	ND
Parathion	8270B	10.0	ND
Parathion methyl	8140	0.3	20.1
Parathion-ethyl	8141A	0.6	30.0
Parathion-methyl	8141A	1.2	60.0
Pentachlorobenzene	8121	0.38	25.46
Pentachlorobenzene	8270B	10.0	ND
Pentachlorobenzene	8250A	-	-
Pentachloroethane	8240B	10.0	500.0
Pentachlorohexane	8120A	-	-
Pentachloronitrobenzene	8270B	20.0	ND
Pentachloronitrobenzene	8250A	-	-
Pentachlorophenol	8151	0.076	0.16
Pentachlorophenol	8250A	36	2412
Pentachlorophenol	8270B	50.0	3300.0
Pentachlorophenol	8040A	74.0	4958.0
Perylene-d12 (I.S.)	8250A	-	-
Phenacetin	8270B	20.0	ND
Phenacetin	8250A	-	-
Phenanthrene	8310	6.4	428.8
Phenanthrene	8270B	10.0	660.0
Phenanthrene	8250A	54	3618
Phenanthrene-d10 (I.S.)	8250A	-	-
Phenobarbital	8270B	10.0	ND
Phenol	8040A	1.4	93.8
Phenol	8270B	10.0	660.0
Phenol	8250A	15	15

Table 1-5 (page 13) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water ( $\mu\text{g/l}$ )	Soil ( $\mu\text{g/Kg}$ )
Phenol-d6 (surr.)	8250A	-	-
Phorate	8141A	0.4	20.0
Phorate	8140	1.5	100.5
Phorate	8270B	10.0	ND
Phosalone	8270B	100.0	ND
Phosmet	8270B	40.0	ND
Phosphamidon	8270B	100.0	ND
Phthalic anhydride	8270B	100.0	ND
Picloram	8151	0.14	
Piperonyl sulfoxide	8270B	100.0	ND
Promecarb	8318	2.5	17
Pronamide	8270B	10.0	ND
Pronamide	8250A	-	-
Propionitrile	8240B	100.0	5000.0
Propoxur (Baygon)	8318	2.4	17
Propylthiouracil	8270B	100.0	ND
Pyrene	8310	2.7	180.9
Pyrene	8270B	10.0	660.0
Pyrene	8250A	19	1273
Pyridine	8270B	ND	ND
Resorcinol	8270B	100.0	ND
Ronnel	8141A	0.7	35.0
Ronnel	8140	3.0	201.0
Safrole	8270B	10.0	ND
Stirophos (Tetrachlorvinphos)	8140	50.0	3350.0
Strychnine	8270B	40.0	ND
Styrene	8021A	0.1	0.1
Styrene	8260A	0.2	0.2
Styrene	8240B	5.0	250.0
Sulfallate	8270B	10.0	ND
Sulfotep	8141A	0.7	35.0
TEPP	8141A	8.0	400.0
Terbufos	8270B	20.0	ND
Terphenyl-d14 (surr.)	8250A	-	-
Tetrachlorobenzenes	8120A	-	-
Tetrachloroethene	8010B	0.3	0.3
Tetrachloroethene	8021A	0.4	0.4
Tetrachloroethene	8260A	0.7	0.7
Tetrachloroethene	8240B	5.0	250.0
Tetrachlorophenols	8040A	-	-
Tetrachlorovinphos	8141A	8.0	400.0
Tetrachlorovinphos	8270B	20.0	ND
Tetraethyl pyrophosphate	8270B	40.0	ND
Thionazine	8270B	20.0	ND
Thiophenol (Benzene-thiol)	8270B	20.0	ND
Tokuthion (Prothiofos)	8140	5.0	335.0
Tokuthion (Protothiofos)	8141A	0.7	55.0
Toluene	8021A	0.1	0.1
Toluene	8260A	0.6	0.6
Toluene	8020B	2.0	2.0
Toluene	8240B	5.0	250.0
Toluene diisocyanate	8270B	100.0	ND
Toxaphene	8080B	2.4	160.8
Toxaphene	8081	-	-
Toxaphene	8250A	-	-
Tri-p-tolyl phosphate(h)	8270B	10.0	ND
Trichloroethene	8021A	0.1	0.1

Table 1-5 (page 14) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (µg/L)	Soil (µg/Kg)
Trichloroethene	8260A	1.0	1.0
Trichloroethene	8010B	1.2	1.2
Trichloroethene	8240B	5.0	250.0
Trichlorofluoromethane	8021A	0.3	0.3
Trichlorofluoromethane	8260A	0.4	0.4
Trichlorofluoromethane	8010B	--	--
Trichloronate	8140	1.5	100.5
Trichloronate	8141A	8.0	400.0
Trichlorophenols	8040A	--	--
Trifluralin	8270B	10.0	ND
Trimethyl phosphate	8270B	10.0	ND
Tris(2,3-dibromopropyl) phosphate	8270B	200.0	ND
Vinyl Chloride	8021A	0.2	0.2
Vinyl Chloride	8260A	0.9	0.9
Vinyl Chloride	8010B	1.8	1.8
Vinyl acetate	8240B	50.0	2500.0
Vinyl chloride	8240B	10.0	500.0
Xylene (Total)	8240B	5.0	250.0
Xylenes	8020B	--	--
2,3-Dimethylphenethylamine	8270B	--	ND
2,3-Dimethylphenethylamine	8250A	--	--
2-Naphthol	8318		
alpha-BHC	8080B	0.03	2.0
alpha-BHC	8081	0.035	1.9
alpha-BHC	8250A	--	--
alpha-Chlordane	8081	0.008	--
alpha-BHC	8121	0.11	7.37
beta-BHC	8081	0.023	3.3
beta-BHC	8080B	0.06	4.0
beta-BHC	8250A	42	2814
beta-BHC	8121	0.31	20.77
cis-1,2-Dichloroethane	8021A	0.1	0.1
cis-1,2-Dichloroethene	8260A	0.6	0.6
cis-1,3-Dichloropropene	8260A	0.0	0.0
cis-1,3-Dichloropropene	8240B	5.0	250.0
cis-1,3-Dichloropropene	8010B	--	--
delta-BHC	8081	0.024	1.1
delta-BHC	8080B	0.09	6.0
delta-BHC	8250A	31	277
delta-BHC	8121	0.2	13.4
gamma-BHC	8080B	0.04	2.7
gamma-BHC (Lindane)	8081	0.025	2
gamma-Chlordane	8081	0.037	1.5
gamma-BHC	8250A	--	--
gamma-BHC	8121	0.23	15.41
1,2-Dibromo-3-chloropropane	8260A	1.3	1.3
1,3,5-Trimethylbenzene	8260A	0.3	0.3
m-Xylene	8021A	0.1	0.1
m-Xylene	8260A	0.3	0.3
n-Butylbenzene	8021A	0.2	0.2
n-Butylbenzene	8260A	0.6	0.6
n-Propylbenzene	8021A	0.04	0.04
n-Propylbenzene	8260A	0.2	0.2
o-Anisidine	8270B	10.0	ND
o-Toluidine	8270B	10.0	ND
o-Xylene	8021A	0.2	0.2
o-Xylene	8260A	0.6	0.6
p-Benzoquinone	8270B	10.0	ND

Table 1-5 (page 15) Organic Analytical Parameters and Estimated Detection Limits			
Compound	Method	Water (ug/L)	Soil (ug/Kg)
p-Cresidine	8270B	10.0	ND
p-Dimethylaminoazobenzene	8250A	-	-
p-Isopropyltoluene	8021A	0.1	0.1
p-Isopropyltoluene	8260A	0.6	0.6
p-Xylene	8021A	0.1	0.1
p-Xylene	8260A	0.7	0.7
sec-Butylbenzene	8021A	0.2	0.2
sec-Butylbenzene	8260A	0.7	0.7
tert-Butylbenzene	8021A	0.6	0.6
tert-Butylbenzene	8260A	0.7	0.7
trans-1,2-Dichloroethene	8260A	0.3	0.3
trans-1,2-Dichloroethene	8021A	0.5	0.5
trans-1,2-Dichloroethene	8010B	1.0	1.0
trans-1,2-Dichloroethene	8240B	5.0	250.0
trans-1,3-Dichloropropene	8260A	0.0	0.0
trans-1,3-Dichloropropene	8010B	3.4	3.4
trans-1,3-Dichloropropene	8240B	5.0	250.0

Table 1-6 Inorganic Analytical Parameters and Estimated Detection Limits			
Analyte	Method	Water mg/l	Soil mg/Kg
Aluminum	6010A	0.045	4.5
	6020	0.0001	0.01
	7020	0.1	10
Antimony	6010A	0.032	3.2
	6020	0.00002	0.002
	7040	0.2	20
	7041	0.003	0.3
Arsenic	6010A	0.053	5.3
	6020	0.004	0.4
	7060A	0.005	0.5
	7061A	0.001	0.1
Barium	6010A	0.002	0.2
	6020	0.00002	0.002
	7080A	0.1	10
	7081	0.002	0.2
Beryllium	6010A	0.0003	0.03
	6020	0.0001	0.01
	7090	0.005	0.5
	7091	0.0002	0.02
Cadmium	6010A	0.004	0.4
	6020	0.00007	0.007
	7130	0.005	0.5
	7130A	0.0001	0.01
Calcium	6010A	0.01	1
	7140	0.01	1
Chromium	6010A	0.007	0.7
	6020	0.00002	0.002
	7090	0.05	5
	7091	0.001	0.1
Cobalt	6010A	0.007	0.7
	6020	0.00001	0.001
	7200	0.05	5
	7201	0.001	0.1
Copper	6010A	0.006	0.6
	6020	0.00003	0.003
	7210	0.02	2
	7211	0.001	0.1
Iron	6010A	0.007	0.7
	7380	0.03	3
	7381	0.001	0.1
Lead	6010A	0.042	4.2
	6020	0.00002	0.002
	7420	0.1	10
	7421	0.001	0.1
Magnesium	6010A	0.03	3
	7450	0.001	0.1
Manganese	6010A	0.002	0.2
	6020	0.0004	0.04
	7460	0.01	1
	7461	0.0002	0.02
Mercury	7470A	0.0002	0.02
	7471A		0.02
Molybdenum	6010A	0.008	0.8
	7480	0.1	10
	7481	0.001	0.1
Nickel	6010A	0.015	1.5
	6020	0.00003	0.003

Table 1-6 (page 2) Inorganic Analytical Parameters and Estimated Detection Limits			
Analyte	Method	Water ug/l	Soil mg/Kg
Nickel	7520	0.04	4
Potassium	7610	0.01	1
	6010A		
Selenium	6010A	0.075	7.5
	7740	0.002	0.2
	7741A		0
Silver	6010A	0.007	0.7
	6020	0.00004	0.004
	7760A	0.01	1
	7761	0.0002	0.02
Sodium	6010A	0.029	2.9
	7770	0.002	0.2
Strontium	6010A	0.0003	0.03
	7780	0.03	3
Thallium	6010A	0.04	4
	6020	0.00005	0.005
	7840	0.1	10
	7841	0.001	0.1
Tin	7870	0.8	80
Vanadium	6010A	0.008	0.8
	7910	0.2	20
	7911	0.004	0.4
Zinc	6010A	0.002	0.2
	6020	0.00008	0.008
	7950	0.005	0.5
	7951	0.00005	0.005
Cyanide	9010A	0.01	0.01
	9012A	0.01	0.01

## 2.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall laboratory Quality Assurance objective of the Site Remediation Program (Program) is to establish minimum guidelines for laboratory analysis and reporting that will assure that all data will be scientifically valid and technically defensible for the purposes of making critical determinations or decisions during remedial activities. These decisions and determinations are divided into two categories. The categories are:

### CATEGORY

- A. Identification of the classes of chemicals of concern and subsequent reduction of sampling and analytical requirements for site remedial response activities;
- B. Demonstration of the sufficiency of site characterizations and investigations; establishment of site cleanup objectives; and demonstration of attainment of site cleanup objectives and specific project objectives.

Meeting the laboratory Quality Assurance objectives for the two Categories of decisions and determinations in the Program requires two levels of quality for the laboratory analytical data. Both levels are variations on the Level III as defined in section 1.5 of this document. For the Program these are referred to as Levels III A and III B. Both of these levels has differing requirements for the performance and reporting of the analytical quality control procedures. The levels required to support the two Categories of decisions and determinations are defined as:

<u>CATEGORY</u>	<u>Level</u>
A	IIIA
B	IIIB

Specific procedures for laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance and corrective action for the two levels are described in other sections of this document. The purpose of this section is to address the specific objectives for accuracy, precision, completeness, representativeness, and comparability for the two levels of data.

## 2.1 DEFINITIONS OF PRECISION AND ACCURACY FOR THE SITE REMEDIATION PROGRAM

### 2.1.1 Precision

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements compared to their average value. Precision is usually expressed in terms of standard deviation but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), and relative range are common.

### 2.1.2 Accuracy

Accuracy measures the ability of the analytical system to render accurate results under a given set of conditions. Accuracy may be expressed as the difference between the value of the reported data and the true value of the parameter being measured. Accuracy is usually stated in terms of percent recovery.

## 2.2 QUALITY CONTROL PROCEDURES USED TO ASSESS PRECISION AND ACCURACY

Trip blank, duplicate, matrix spike, and surrogate samples should be analyzed to assess the quality of the data resulting from the sampling and analysis program.

### 2.2.1 Accuracy

Analytical accuracy is assessed by performing surrogate spikes for each sample (organic analyses), matrix spikes on selected samples, and analyzing laboratory blanks, trip/travel blanks and known or blind reference samples. Additionally, initial, continuing and final equipment calibrations must be performed and accomplished within established limits to define the equipments' accuracy before analytical accuracy can be determined for any sample set.

Trip/travel blanks consisting of distilled water, should be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field sampling program. Trip/travel blanks are used to assess the potential for contamination of samples due to contaminant migration during sample bottle preparation, sample shipment, and storage.

### 2.2.2 Precision

Analytical precision is assessed by performing laboratory duplicate sample analysis. To assess precision for organic analyses all matrix spikes are performed in duplicate.

## 2.3 FREQUENCY OF QUALITY CONTROL PROCEDURES AND OBJECTIVES FOR PRECISION AND ACCURACY

Table 2-2 contains the precision and accuracy objectives for Level III A data used to support Category A decisions and determinations. The tables contain the precision and accuracy objectives arranged by analytical method.

Tables 2-3 through 2-58 contain the precision and accuracy objectives for Level III B used to support Category B decisions and determinations. The tables contain the precision and accuracy objectives arranged by analytical method.

Table 2-1 contains required minimum frequency for method blank, duplicate, matrix spike, and surrogate samples for Levels IIIA and IIIB data.

## 2.4 REPRESENTATIVENESS, COMPLETENESS AND COMPARABILITY

### 2.4.1 Representativeness

Representativeness expresses the degree to which sample data accurately represent the site, a specific matrix or parameter variations at a sampling point. Representativeness is a qualitative parameter which is dependent on both the proper design of the sampling program and proper laboratory protocol. The analytical representativeness criterion will be satisfied by making certain that proper analytical procedures are utilized, preservation requirements are met and holding times are not exceeded.

### 2.4.2 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

Table 2-2 contains the completeness objectives for Level III A data used to support Category A decisions and determinations.

Tables 2-3 through 2-58 contain the completeness objectives for Level III B data used to support Category B decisions and determinations.

### 2.4.3 Comparability

Comparability expresses the confidence with which one data set can be compared to another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The analytical procedures used to obtain the planned analytical data, as documented in this Analytical Quality Assurance Program, are expected to provide the Illinois EPA Site Remediation Program with comparable analytical data for all Site Remediation sites. This comparability criteria applies only to the Level III B data used to support Category B decisions and determinations.

## 2.5 QA/QC Targets

Target values for detection limit, percent recoveries and percent "true" value of known check standards, and RPD of duplicate/replicates are provided in Sections 1 and 2 of this Analytical Quality Assurance Plan (AQAP). It is important to note that tabulated values may not be attainable. For example, high contaminant concentrations, sample nonhomogeneity, and matrix interferences can preclude achievement of target detection limits or other QC criteria. In such instances, the data report must contain a case narrative which must indicate the occurrence and

cause of any deviation from the tabulated detection limits or any other noncompliance with specified QC criteria.

## 2.6 FAILURE TO MEET AGENCY QUALITY ASSURANCE OBJECTIVES

Failure to meet the Agency's quality assurance objectives for the Program may result in data which is not considered valid and which cannot be held in support of any critical decision or determination by the Agency. In the event that the laboratory believes that the Agency's Program quality assurance objectives can not be met due to sample matrix effects, the participant's Project Manager may request a change or modification of the Agency's Program quality assurance objectives from the Agency's Project Manager. Any such request must contain sufficient supporting documentation to allow the Agency's Division of Laboratories, Quality Assurance Section to review the request and advise the Agency's Project Manager of the validity of the request for change or modification of the Agency's Program quality assurance objectives. Appendix A of this AQAP contains copies of the necessary data reporting forms for reporting all Program data to the Agency and Section 6 contains the data reporting flags that must be used when reporting data to the Program. Section 6 contains the data reporting flags to be used for reporting both data that meets Program quality assurance objectives and data that fails Program quality assurance objectives.

The request for change or modification must indicate that the laboratory or the Program participant represents that due to insurmountable sample matrix affects on the analyses, the data are: 1) usable as a quantitative concentration, 2) usable with caution as an estimated concentration, or 3) unusable due to out-of-control QC results.

<b>Table 2-1 Laboratory Quality Control Frequencies</b>					
	<b>Levels</b>	<b>Method Blanks</b>	<b>Laboratory Duplicates*</b>	<b>Matrix Spikes*</b>	<b>Surrogates</b>
<b>Organic Parameters</b>	III A	1 per matrix batch	1 per 20 or fewer samples	1 per 20 or fewer samples	Every Sample
	III B	1 per matrix batch Maximum batch size is 20 samples	1 per 10 or fewer samples per matrix	1 per 10 or fewer samples per matrix	Every Sample
<b>Inorganic Parameters</b>	III A	1 per matrix batch	1 per 20 or fewer samples	1 per 20 or fewer samples	None
	III B	1 per matrix batch Maximum batch size is 20 samples	1 per 10 or fewer samples per matrix	1 per 10 or fewer samples per matrix	None

\* For organic parameters the analysis of Matrix Spike/Matrix Spike Duplicates fulfills the requirements for Laboratory Duplicates and Matrix Spikes

TABLE 2-2 Precision, Accuracy and Completeness Level IIIA Objectives					
Analyte	Method	Matrix	Precision (RPD) a	Accuracy (%Recovery) b	% Completeness
Volatile Organic Compounds	8260A	Aqueous	< 25%	50 - 150	80
Semi-Volatile Organic Compounds	8270B	Aqueous	<50%	25 - 150	80
Pesticides & PCBs	8081	Aqueous	<35%	25 - 150	80
Metals	6010A,7060A, 7061A,7062,7421, 7470A,7471A, 7841 & 9012	Aqueous	<25%	70 - 130	80

Volatile Organic Compounds	8260A	Solid	<30%	50 - 200	80
Semi-Volatile Organic Compounds	8270B	Solid	<60%	25 - 200	80
Pesticides & PCBs	8081	Solid	<60%	25 - 150	80
Metals	6010A,7060A, 7061A,7062,7421 7470A,7471A, 7841 & 9012	Solid	<40%	60 - 140	80

- a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

**TABLE 2-3**  
**METHOD 8010B Aqueous - Level III B Objectives**

COMPOUND	Precision (RPD)a	Accuracy (%Recovery)b	Completeness (%)
Bromodichloromethane	<15%	80-134	90%
Bromoform	<15%	72-125	90%
Bromomethane	<20%	57-125	90%
Carbon tetrachloride	<15%	70-127	90%
Chlorobenzene	<15%	75-128	90%
Chloroethane	<15%	75-128	90%
2-Chloroethyl vinyl ether	<20%	65-135	90%
Chloroform	<15%	75-130	90%
Chloromethane	<20%	50-139	90%
Dibromochloromethane	<15%	72-122	90%
1,2-Dichlorobenzene	<15%	76-123	90%
1,3-Dichlorobenzene	<20%	68-132	90%
1,4-Dichlorobenzene	<15%	75-122	90%
1,1-Dichloroethane	<15%	79-119	90%
1,2-Dichloroethane	<15%	80-120	90%
1,1-Dichloroethene	<20%	69-125	90%
trans-1,2-Dichloroethene	<15%	79-125	90%
Dichloromethane	<15%	70-130	90%
1,2-Dichloropropane	<15%	77-123	90%
cis-1,3-Dichloropropene	<20%	68-132	90%
trans-1,3-Dichloropropene	<15%	68-132	90%
1,1,2,2-Tetrachloroethane	<15%	70-130	90%
Tetrachloroethene	<15%	75-123	90%
1,1,1-Trichloroethane	<15%	72-128	90%
1,1,2-Trichloroethane	<15%	67-123	90%
Trichloroethene	<15%	68-128	90%
Trichlorofluoromethane	<15%	65-123	90%
Vinyl Chloride	<25%	70-128	90%

**TABLE 2-4**  
**METHOD 8010B Solids Level III B Objectives**

Compound	Precision (RPD)a	Accuracy (%Recovery)b	Completeness (%)
Bromodichloromethane	<25%	70-140	90%
Bromoform	<25%	60-125	90%
Bromomethane	<25%	40-140	90%
Carbon tetrachloride	<25%	60-140	90%
Chlorobenzene	<25%	70-130	90%
Chloroethane	<25%	70-130	90%
2-Chloroethyl vinyl ether	<25%	50-140	90%
Chloroform	<25%	60-120	90%
Chloromethane	<25%	30-140	90%
Dibromochloromethane	<25%	60-130	90%
1,2-Dichlorobenzene	<25%	65-125	90%
1,3-Dichlorobenzene	<25%	60-130	90%
1,4-Dichlorobenzene	<25%	65-125	90%
1,1-Dichloroethane	<25%	65-125	90%
1,2-Dichloroethane	<25%	70-130	90%
1,1-Dichloroethene	<25%	60-140	90%
trans-1,2-Dichloroethene	<25%	70-125	90%
Dichloromethane	<25%	60-125	90%
1,2-Dichloropropane	<25%	65-140	90%
cis-1,3-Dichloropropene	<25%	60-150	90%
trans-1,3-Dichloropropene	<25%	60-150	90%
1,1,2,2-Tetrachloroethane	<25%	60-125	90%
Tetrachloroethene	<25%	65-120	90%
1,1,1-Trichloroethane	<25%	65-120	90%
1,1,2-Trichloroethane	<25%	60-120	90%
Trichloroethene	<25%	60-120	90%
Trichlorofluoromethane	<25%	60-120	90%
Vinyl Chloride	<25%	60-140	90%

TABLE 2-5 METHOD 8011 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
1,2-Dibromo-3-chloropropane (DBCP)	<15%	80-120	90%
1,2-Dibromoethane (EDB)	<15%	80-120	90%

TABLE 2-6 METHOD 8011 Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
1,2-Dibromo-3-chloropropane (DBCP)	<20%	75-125	90%
1,2-Dibromoethane (EDB)	<20%	75-125	90%

TABLE 2-7 METHOD 8015A Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Diethyl ether	<20%	70-130	90%
Ethanol	<20%	70-130	90%
Methyl ethyl ketone (MEK)	<20%	70-130	90%
Methyl isobutyl ketone (MIBK)	<20%	70-130	90%

TABLE 2-8 METHOD 8015A Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Diethyl ether	<30%	55-145	90%
Ethanol	<30%	55-145	90%
Methyl ethyl ketone (MEK)	<30%	55-145	90%
Methyl isobutyl ketone (MIBK)	<30%	55-145	90%

TABLE 2-9 METHOD 8020A Aqueous Level III B Objectives			
COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 10%	84-115	90%
Chlorobenzene	< 10%	75-115	90%
1,2-Dichlorobenzene	< 15%	78-115	90%
1,3-Dichlorobenzene	< 10%	82-115	90%
1,4-Dichlorobenzene	< 10%	80-115	90%
Ethyl Benzene	< 10%	78-115	90%
Toluene	< 10%	85-115	90%

- <sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

**TABLE 2-10**  
**METHOD 8020A Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 20%	75-125	90%
Chlorobenzene	< 20%	75-125	90%
1,2-Dichlorobenzene	< 20%	75-125	90%
1,3-Dichlorobenzene	< 20%	75-125	90%
1,4-Dichlorobenzene	< 20%	75-125	90%
Ethyl Benzene	< 20%	75-125	90%
Toluene	< 20%	75-125	90%

**TABLE 2-11**  
**METHOD 8021A Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 20%	80-120	90%
Bromobenzene	< 20%	80-120	90%
Bromochloromethane	< 20%	80-120	90%
Bromodichloromethane	< 20%	80-120	90%
Bromoform	< 20%	80-120	90%
Bromomethane	< 20%	80-120	90%
n-Butylbenzene	< 20%	80-120	90%
sec-Butylbenzene	< 20%	80-120	90%
tert-Butylbenzene	< 20%	80-120	90%
Carbon Tetrachloride	< 20%	80-120	90%
Chlorobenzene	< 20%	80-120	90%
Chlorodibromomethane	< 20%	80-120	90%
Chloroethane	< 20%	80-120	90%
Chloroform	< 20%	80-120	90%
Chloromethane	< 20%	69-123	90%
2-Chlorotoluene	< 20%	80-120	90%
4-Chlorotoluene	< 20%	80-120	90%
1,2-Dibromo-3-Chloropropane	< 20%	60-120	90%
1,2-Dibromoethane	< 20%	80-120	90%
Dibromomethane	< 20%	80-120	90%
1,2-Dichlorobenzene	< 20%	80-120	90%
1,3-Dichlorobenzene	< 20%	80-120	90%
1,4-Dichlorobenzene	< 20%	80-120	90%
Dichlorodifluoromethane	< 20%	71-110	90%
1,1-Dichloroethane	< 20%	80-120	90%
1,2-Dichloroethane	< 20%	80-120	90%
1,1-Dichloroethene	< 20%	80-120	90%
cis-1,2-Dichloroethene	< 20%	80-120	90%
trans-1,2-Dichloroethene	< 20%	80-120	90%
1,2-Dichloropropane	< 20%	80-120	90%
1,3-Dichloropropane	< 20%	80-120	90%
2,2-Dichloropropane	< 20%	80-120	90%
1,1-Dichloropropene	< 20%	80-120	90%
cis-1,3-dichloropropene	< 20%	80-120	90%
trans-1,3-dichloropropene	< 20%	80-120	90%
Ethylbenzene	< 20%	80-120	90%
Hexachlorobutadiene	< 20%	70-128	90%
Isopropylbenzene	< 20%	80-120	90%
p-Isopropyltoluene	< 20%	80-120	90%
Methylene Chloride	< 20%	80-120	90%
Naphthalene	< 20%	80-120	90%

TABLE 2-5 METHOD 8011 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
1,2-Dibromo-3-chloropropane (DBCP)	<15%	80-120	90%
1,2-Dibromoethane (EDB)	<15%	80-120	90%

TABLE 2-6 METHOD 8011 Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
1,2-Dibromo-3-chloropropane (DBCP)	<20%	75-125	90%
1,2-Dibromoethane (EDB)	<20%	75-125	90%

TABLE 2-7 METHOD 8015A Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Diethyl ether	<20%	70-130	90%
Ethanol	<20%	70-130	90%
Methyl ethyl ketone (MEK)	<20%	70-130	90%
Methyl isobutyl ketone (MIBK)	<20%	70-130	90%

TABLE 2-8 METHOD 8015A Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Diethyl ether	<30%	55-145	90%
Ethanol	<30%	55-145	90%
Methyl ethyl ketone (MEK)	<30%	55-145	90%
Methyl isobutyl ketone (MIBK)	<30%	55-145	90%

TABLE 2-9 METHOD 8020A Aqueous Level III B Objectives			
COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 10%	84-115	90%
Chlorobenzene	< 10%	75-115	90%
1,2-Dichlorobenzene	< 15%	78-115	90%
1,3-Dichlorobenzene	< 10%	82-115	90%
1,4-Dichlorobenzene	< 10%	80-115	90%
Ethyl Benzene	< 10%	78-115	90%
Toluene	< 10%	85-115	90%

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

**TABLE 2-10**  
**METHOD 8020A Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 20%	75-125	90%
Chlorobenzene	< 20%	75-125	90%
1,2-Dichlorobenzene	< 20%	75-125	90%
1,3-Dichlorobenzene	< 20%	75-125	90%
1,4-Dichlorobenzene	< 20%	75-125	90%
Ethyl Benzene	< 20%	75-125	90%
Toluene	< 20%	75-125	90%

**TABLE 2-11**  
**METHOD 8021A Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 20%	80-120	90%
Bromobenzene	< 20%	80-120	90%
Bromochloromethane	< 20%	80-120	90%
Bromodichloromethane	< 20%	80-120	90%
Bromoform	< 20%	80-120	90%
Bromomethane	< 20%	80-120	90%
n-Butylbenzene	< 20%	80-120	90%
sec-Butylbenzene	< 20%	80-120	90%
tert-Butylbenzene	< 20%	80-120	90%
Carbon Tetrachloride	< 20%	80-120	90%
Chlorobenzene	< 20%	80-120	90%
Chlorodibromomethane	< 20%	80-120	90%
Chloroethane	< 20%	80-120	90%
Chloroform	< 20%	80-120	90%
Chloromethane	< 20%	69-123	90%
2-Chlorotoluene	< 20%	80-120	90%
4-Chlorotoluene	< 20%	80-120	90%
1,2-Dibromo-3-Chloropropane	< 20%	60-120	90%
1,2-Dibromoethane	< 20%	80-120	90%
Dibromomethane	< 20%	80-120	90%
1,2-Dichlorobenzene	< 20%	80-120	90%
1,3-Dichlorobenzene	< 20%	80-120	90%
1,4-Dichlorobenzene	< 20%	80-120	90%
Dichlorodifluoromethane	< 20%	71-110	90%
1,1-Dichloroethane	< 20%	80-120	90%
1,2-Dichloroethane	< 20%	80-120	90%
1,1-Dichloroethene	< 20%	80-120	90%
cis-1,2-Dichloroethane	< 20%	80-120	90%
trans-1,2-Dichloroethene	< 20%	80-120	90%
1,2-Dichloropropane	< 20%	80-120	90%
1,3-Dichloropropane	< 20%	80-120	90%
2,2-Dichloropropane	< 20%	80-120	90%
1,1-Dichloropropene	< 20%	80-120	90%
cis-1,3-dichloropropene	< 20%	80-120	90%
trans-1,3-dichloropropene	< 20%	80-120	90%
Ethylbenzene	< 20%	80-120	90%
Hexachlorobutadiene	< 20%	70-128	90%
Isopropylbenzene	< 20%	80-120	90%
p-Isopropyltoluene	< 20%	80-120	90%
Methylene Chloride	< 20%	80-120	90%
Naphthalene	< 20%	80-120	90%

**TABLE 2-11**  
**METHOD 8021A Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
n-Propylbenzene	< 20%	80-120	90%
Styrene	< 20%	80-120	90%
1,1,1,2-Tetrachloroethane	< 20%	80-120	90%
1,1,2,2-Tetrachloroethane	< 20%	80-120	90%
Tetrachloroethene	< 20%	80-120	90%
Toluene	< 20%	80-120	90%
1,2,3-Trichlorobenzene	< 20%	80-120	90%
1,2,4-Trichlorobenzene	< 20%	80-120	90%
1,1,1-Trichloroethane	< 20%	80-120	90%
1,1,2-Trichloroethane	< 20%	80-120	90%
Trichloroethene	< 20%	80-120	90%
Trichlorofluoromethane	< 20%	80-120	90%
1,2,3-Trichloropropane	< 20%	80-120	90%
1,2,4-Trimethylbenzene	< 20%	80-120	90%
1,3,5-Trimethylbenzene	< 20%	80-120	90%
Vinyl Chloride	< 20%	80-120	90%
o-Xylene	< 20%	80-120	90%
m-Xylene	< 20%	80-120	90%
p-Xylene	< 20%	80-120	90%

**TABLE 2-12**  
**METHOD 8021A Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	< 20%	75-125	90%
Bromobenzene	< 20%	75-125	90%
Bromochloromethane	< 20%	75-125	90%
Bromodichloromethane	< 20%	75-125	90%
Bromoform	< 20%	75-125	90%
Bromomethane	< 20%	75-125	90%
n-Butylbenzene	< 20%	75-125	90%
sec-Butylbenzene	< 20%	75-125	90%
tert-Butylbenzene	< 20%	75-125	90%
Carbon Tetrachloride	< 20%	75-125	90%
Chlorobenzene	< 20%	75-125	90%
Chlorodibromomethane	< 20%	75-125	90%
Chloroethane	< 20%	75-125	90%
Chloroform	< 20%	75-125	90%
Chloromethane	< 20%	75-125	90%
2-Chlorotoluene	< 20%	75-125	90%
4-Chlorotoluene	< 20%	75-125	90%
1,2-Dibromo-3-Chloropropane	< 20%	75-125	90%
1,2-Dibromoethane	< 20%	75-125	90%
Dibromomethane	< 20%	75-125	90%
1,2-Dichlorobenzene	< 20%	75-125	90%
1,3-Dichlorobenzene	< 20%	75-125	90%
1,4-Dichlorobenzene	< 20%	75-125	90%
Dichlorodifluoromethane	< 20%	75-125	90%
1,1-Dichloroethane	< 20%	75-125	90%
1,2-Dichloroethane	< 20%	75-125	90%
1,1-Dichloroethene	< 20%	75-125	90%
cis-1,2-Dichloroethane	< 20%	75-125	90%
trans-1,2-Dichloroethene	< 20%	75-125	90%
1,2-Dichloropropane	< 20%	75-125	90%

**TABLE 2-12**  
**METHOD 8021A Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
2,2-Dichloropropane	< 20%	75-125	90%
1,1-Dichloropropene	< 20%	75-125	90%
cis-1,3-dichloropropene	< 20%	75-125	90%
trans-1,3-dichloropropene	< 20%	75-125	90%
Ethylbenzene	< 20%	75-125	90%
Hexachlorobutadiene	< 20%	75-125	90%
Isopropylbenzene	< 20%	75-125	90%
p-Isopropyltoluene	< 20%	75-125	90%
Methylene Chloride	< 20%	75-125	90%
Naphthalene	< 20%	75-125	90%
n-Propylbenzene	< 20%	75-125	90%
Styrene	< 20%	75-125	90%
1,1,1,2-Tetrachloroethane	< 20%	75-125	90%
1,1,2,2-Tetrachloroethane	< 20%	75-125	90%
Tetrachloroethene	< 20%	75-125	90%
Toluene	< 20%	75-125	90%
1,2,3-Trichlorobenzene	< 20%	75-125	90%
1,2,4-Trichlorobenzene	< 20%	75-125	90%
1,1,1-Trichloroethane	< 20%	75-125	90%
1,1,2-Trichloroethane	< 20%	75-125	90%
Trichloroethene	< 20%	75-125	90%
Trichlorofluoromethane	< 20%	75-125	90%
1,2,3-Trichloropropane	< 20%	75-125	90%
1,2,4-Trimethylbenzene	< 20%	75-125	90%
1,3,5-Trimethylbenzene	< 20%	75-125	90%
Vinyl Chloride	< 20%	75-125	90%
o-Xylene	< 20%	75-125	90%
m-Xylene	< 20%	75-125	90%
p-Xylene	< 20%	75-125	90%

**TABLE 2-13**  
**METHOD 8030A Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Acrolein	< 20%	84-110	90%
Acrylonitrile	< 20%	88-112	90%

**TABLE 2-14**  
**METHOD 8030A Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Acrolein	< 30%	75-125	90%
Acrylonitrile	< 30%	75-125	90%

**TABLE 2-15**  
**METHOD 8031 Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Acrylonitrile	< 15%	75-125	90%

**TABLE 2-16**  
**METHOD 8031 Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Acrylonitrile	< 30%	65-135	90%

**TABLE 2-17**  
**METHOD 8032 Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Acrylamide	< 15%	75-125	90%

**TABLE 2-18**  
**METHOD 8032 Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Acrylamide	< 30%	65-135	90%

**TABLE 2-19**  
**METHOD 8040A Aqueous Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
2,4,6-Trichlorophenol	< 20%	75-125	90%
2,4-Dichlorophenol	< 20%	70-125	90%
2,4-Dimethylphenol	< 20%	60-125	90%
2,4-Dinitrophenol	< 20%	60-125	90%
2,6-Dichlorophenol	< 20%	65-125	90%
2-Chlorophenol	< 20%	65-125	90%
2-Cyclohexyl-4,6-dinitrophenol	< 20%	60-125	90%
2-Methyl-4,6-dinitrophenol	< 20%	65-125	90%
2-Nitrophenol	< 20%	70-125	90%
2-sec-Butyl-4,6-dinitrophenol	< 20%	65-125	90%
4-Chloro-3-methylphenol	< 20%	75-125	90%
4-Nitrophenol	< 20%	50-125	90%
Cresols (methyl phenol)	< 20%	60-125	90%
Pentachlorophenol	< 20%	65-125	90%
Phenol	< 20%	50-125	90%
Tetrachlorophenols	< 20%	65-125	90%
Trichlorophenols	< 20%	65-125	90%

**TABLE 2-20**  
**METHOD 8040A Solids Level III B Objectives**

COMPOUND	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
2,4,6-Trichlorophenol	< 25%	50-120	90%
2,4-Dichlorophenol	< 25%	50-120	90%
2,4-Dimethylphenol	< 25%	45-120	90%
2,4-Dinitrophenol	< 25%	50-120	90%
2,6-Dichlorophenol	< 25%	50-120	90%
2-Chlorophenol	< 25%	50-120	90%
2-Cyclohexyl-4,6-dinitrophenol	< 25%	50-120	90%
2-Methyl-4,6-dinitrophenol	< 25%	50-120	90%
2-Nitrophenol	< 25%	50-120	90%
2-sec-Butyl-4,6-dinitrophenol	< 25%	50-120	90%
4-Chloro-3-methylphenol	< 25%	60-120	90%
4-Nitrophenol	< 25%	45-120	90%
Cresols (methyl phenol)	< 25%	50-120	90%
Pentachlorophenol	< 25%	50-120	90%
Phenol	< 25%	45-120	90%
Tetrachlorophenols	< 25%	50-120	90%
Trichlorophenols	< 25%	50-120	90%

TABLE 2-21 METHOD 8060 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Benzyl butyl phthalate	<20%	65-110	90%
Bis(2-ethylhexyl) phthalate	<20%	50-110	90%
Di-n-butyl phthalate	<20%	65-110	90%
Di-n-octyl phthalate	<20%	50-110	90%
Diethyl phthalate	<20%	55-110	90%
Dimethyl phthalate	<20%	65-110	90%

TABLE 2-22 METHOD 8060 Solids Level III B Objectives			
	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Benzyl butyl phthalate	<25%	55-120	90%
Bis(2-ethylhexyl) phthalate	<25%	55-120	90%
Di-n-butyl phthalate	<25%	55-120	90%
Di-n-octyl phthalate	<25%	55-120	90%
Diethyl phthalate	<25%	55-120	90%
Dimethyl phthalate	<25%	55-120	90%

TABLE 2-23 METHOD 8061 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Bis(2-n-butoxyethyl) phthalate	<20%	78-110	90%
Bis(2-ethoxyethyl) phthalate	<20%	70-110	90%
Bis(2-ethylhexyl) phthalate	<20%	75-110	90%
Bis(2-methoxyethyl) phthalate	<20%	70-110	90%
Bis(4-methyl-2-pentyl) phthalate	<20%	60-130	90%
Butyl benzyl phthalate	<20%	72-110	90%
Diamyl phthalate	<20%	65-112	90%
Di-n-butyl phthalate	<20%	60-125	90%
Dicyclohexyl phthalate	<20%	50-135	90%
Diethyl phthalate	<20%	60-135	90%
Dihexyl phthalate	<20%	68-115	90%
Diisobutyl phthalate	<20%	60-140	90%
Dimethyl phthalate	<20%	65-115	90%
Dinonyl phthalate	<20%	60-125	90%
Di-n-octyl phthalate	<20%	76-115	90%
Hexyl 2-ethylhexyl phthalate	<20%	60-135	90%

- a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

TABLE 2-24 METHOD 8061 Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Bis(2-n-butoxyethyl) phthalate	<30%	60-140	90%
Bis(2-ethoxyethyl) phthalate	<30%	60-140	90%
Bis(2-ethylhexyl) phthalate	<30%	65-140	90%
Bis(2-methoxyethyl) phthalate	<30%	50-150	90%
Bis(4-methyl-2-pentyl) phthalate	<30%	55-130	90%
Butyl benzyl phthalate	<30%	60-140	90%
Diamyl phthalate	<30%	55-140	90%
Di-n-butyl phthalate	<30%	65-140	90%
Dicyclohexyl phthalate	<30%	55-150	90%
Diethyl phthalate	<30%	55-150	90%
Dihexyl phthalate	<30%	70-130	90%
Diisobutyl phthalate	<30%	75-130	90%
Dimethyl phthalate	<30%	65-135	90%
Dinonyl phthalate	<30%	75-130	90%
Di-n-octyl phthalate	<30%	75-140	90%
Hexyl 2-ethylhexyl phthalate	<30%	60-140	90%

TABLE 2-25 METHOD 8070 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
N-Nitrosodi-n-propylamine	<20%	40-120	90%
N-Nitrosodimethylamine	<20%	65-120	90%
N-Nitrosodiphenylamine	<20%	60-120	90%

TABLE 2-26 METHOD 8070 Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
N-Nitrosodi-n-propylamine	<25%	50-120	90%
N-Nitrosodimethylamine	<25%	60-120	90%
N-Nitrosodiphenylamine	<25%	60-120	90%

- a Relative Percent Difference of Duplicate Sample analyses
- b Percent Recovery of Spike Sample analyses

TABLE 2-27 METHOD 8080B/8081 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
4,4'-DDE	<20%	65-110	90%
4,4'-DDT	<20%	70-120	90%
4,4'-DDD	<20%	65-110	90%
Aldrin	<20%	70-110	90%
Chlordane (technical)	<20%	70-110	90%
Dieldrin	<20%	75-110	90%
Endosulfan I	<20%	80-115	90%
Endosulfan II	<20%	60-138	90%
Endosulfan sulfate	<20%	70-111	90%
Endrin	<20%	70-111	90%
Endrin aldehyde	<20%	60-115	90%
Heptachlor	<20%	65-110	90%
Heptachlor epoxide	<20%	70-112	90%
Methoxychlor	<20%	70-115	90%
PCB-1016	<20%	70-110	90%
PCB-1221	<20%	65-130	90%
PCB-1232	<20%	65-120	90%
PCB-1242	<20%	65-120	90%
PCB-1248	<20%	65-120	90%
PCB-1254	<20%	65-120	90%
PCB-1260	<20%	65-120	90%
Toxaphene	<20%	70-120	90%
alpha-BHC	<20%	70-110	90%
beta-BHC	<20%	65-110	90%
delta-BHC	<20%	70-110	90%
gamma-BHC	<20%	70-110	90%

- a Relative Percent Difference of Duplicate Sample analyses
- b Percent Recovery of Spike Sample analyses

TABLE 2-28  
 METHOD 8080B/8081 Solids Level III B Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
4,4'-DDE	<25%	60-135	90%
4,4'-DDT	<25%	65-135	90%
4,4'-DDD	<25%	60-135	90%
Aldrin	<25%	65-135	90%
Chlordane (technical)	<25%	70-135	90%
Dieldrin	<25%	70-135	90%
Endosulfan I	<25%	75-135	90%
Endosulfan II	<25%	55-140	90%
Endosulfan sulfate	<25%	70-135	90%
Endrin	<25%	70-135	90%
Endrin aldehyde	<25%	55-140	90%
Heptachlor	<25%	60-135	90%
Heptachlor epoxide	<25%	70-135	90%
Methoxychlor	<25%	70-135	90%
PCB-1016	<25%	70-135	90%
PCB-1221	<25%	60-135	90%
PCB-1232	<25%	60-135	90%
PCB-1242	<25%	60-135	90%
PCB-1248	<25%	60-135	90%
PCB-1254	<25%	60-135	90%
PCB-1270	<25%	60-135	90%
Toxaphene	<25%	70-135	90%
alpha-BHC	<25%	70-135	90%
beta-BHC	<25%	70-135	90%
delta-BHC	<25%	70-135	90%
gamma-BHC	<25%	70-135	90%

- a Relative Percent Difference of Duplicate Sample analyses
- b Percent Recovery of Spike Sample analyses

**TABLE 2-29**  
**METHOD 8090 Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery)	Completeness (%)
2,4-Dinitrotoluene	<20%	60-120	90%
2,6-Dinitrotoluene	<20%	60-120	90%
Isophorone	<20%	60-120	90%
Nitrobenzene	<20%	60-120	90%

**TABLE 2-30**  
**METHOD 8090 Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery)	Completeness (%)
2,4-Dinitrotoluene	<30%	60-120	90%
2,6-Dinitrotoluene	<30%	60-120	90%
Isophorone	<30%	60-120	90%
Nitrobenzene	<30%	60-120	90%

**TABLE 2-31**  
**METHOD 8110 Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery)	Completeness (%)
4-Bromophenyl phenyl ether	<20%	70-120	90%
4-Chlorophenyl phenyl ether	<20%	65-120	90%
Bis(2-chloroethoxy) methane	<20%	65-120	90%
Bis(2-chloroethyl) ether	<20%	65-120	90%
Bis(2-chloroisopropyl) ether	<20%	65-120	90%

**TABLE 2-32**  
**METHOD 8110 Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery)	Completeness (%)
4-Bromophenyl phenyl ether	<30%	60-140	90%
4-Chlorophenyl phenyl ether	<30%	60-140	90%
Bis(2-chloroethoxy) methane	<30%	60-140	90%
Bis(2-chloroethyl) ether	<30%	60-140	90%
Bis(2-chloroisopropyl) ether	<30%	60-140	90%

**TABLE 2-33**  
**METHOD 8120A Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
1,2,4-Trichlorobenzene	<20%	75-110	90%
1,2-Dichlorobenzene	<20%	75-110	90%
1,3-Dichlorobenzene	<20%	75-110	90%
1,4-Dichlorobenzene	<20%	75-110	90%
2-Chloronaphthalene	<20%	75-110	90%
Hexachlorobenzene	<20%	75-110	90%
Hexachlorobutadiene	<20%	75-110	90%
Hexachlorocyclopentadiene	<20%	75-110	90%
Hexachloroethane	<20%	75-110	90%

**TABLE 2-34**  
**METHOD 8120A Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
1,2,4-Trichlorobenzene	<25%	70-150	90%
1,2-Dichlorobenzene	<25%	70-150	90%
1,3-Dichlorobenzene	<25%	70-150	90%
1,4-Dichlorobenzene	<25%	70-150	90%
2-Chloronaphthalene	<25%	70-150	90%
Hexachlorobenzene	<25%	70-150	90%
Hexachlorobutadiene	<25%	70-150	90%
Hexachlorocyclopentadiene	<25%	70-150	90%
Hexachloroethane	<25%	70-150	90%

**TABLE 2-35**  
**METHOD 8121 Aqueous Level IIIB Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Benzal chloride	<25%	70-135	90%
Benzotrichloride	<25%	70-135	90%
Benzyl chloride	<25%	70-135	90%
2-Chloronaphthalene	<25%	70-135	90%
1,2-Dichlorobenzene	<25%	70-135	90%
1,3-Dichlorobenzene	<25%	70-135	90%
1,4-Dichlorobenzene	<25%	70-135	90%
Hexachlorobenzene	<25%	70-135	90%
Hexachlorobutadiene	<25%	70-135	90%
alpha-BHC	<25%	70-135	90%
beta-BHC	<25%	70-135	90%
gamma-BHC	<25%	70-135	90%
delta-BHC	<25%	70-135	90%
Hexachlorocyclopentadiene	<25%	70-135	90%
Hexachloroethane	<25%	70-135	90%
Pentachlorobenzene	<25%	70-135	90%
1,2,3,4-Tetrachlorobenzene	<25%	70-135	90%
1,2,4,5-Tetrachlorobenzene	<25%	70-135	90%
1,2,3,5-Tetrachlorobenzene	<25%	70-135	90%
1,2,4-Trichlorobenzene	<25%	70-135	90%
1,2,3-Trichlorobenzene	<25%	70-135	90%
1,3,5-Trichlorobenzene	<25%	70-135	90%
a,2,6-Trichlorotoluene	<25%	70-135	90%
1,4-Dichloronaphthalene	<25%	70-135	90%
2,3,4,5,6-Pentachlorotoluene	<25%	70-135	90%

- <sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

TABLE 2-36 METHOD 8121 Solid Level IIIB Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Benzal chloride	<25%	70-135	90%
Benzotrichloride	<25%	70-135	90%
Benzyl chloride	<25%	70-135	90%
2-Chloronaphthalene	<25%	70-135	90%
1,2-Dichlorobenzene	<25%	70-135	90%
1,3-Dichlorobenzene	<25%	70-135	90%
1,4-Dichlorobenzene	<25%	70-135	90%
Hexachlorobenzene	<25%	70-135	90%
Hexachlorobutadiene	<25%	70-135	90%
alpha-BHC	<25%	70-135	90%
beta-BHC	<25%	70-135	90%
gamma-BHC	<25%	70-135	90%
delta-BHC	<25%	70-135	90%
Hexachlorocyclopentadiene	<25%	70-135	90%
Hexachloroethane	<25%	70-135	90%
Pentachlorobenzene	<25%	70-135	90%
1,2,3,4-Tetrachlorobenzene	<25%	70-135	90%
1,2,4,5-Tetrachlorobenzene	<25%	70-135	90%
1,2,3,5-Tetrachlorobenzene	<25%	70-135	90%
1,2,4-Trichlorobenzene	<25%	70-135	90%
1,2,3-Trichlorobenzene	<25%	70-135	90%
1,3,5-Trichlorobenzene	<25%	70-135	90%
a,2,6-Trichlorotoluene	<25%	70-135	90%
1,4-Dichloronaphthalene	<25%	70-135	90%
2,3,4,5,6-Pentachlorotoluene	<25%	70-135	90%

- a Relative Percent Difference of Duplicate Sample analyses
- b Percent Recovery of Spike Sample analyses

**TABLE 2-37**  
**METHOD 8140 Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Azinphos methyl	<25%	60-130	90%
Bolstar	<25%	60-120	90%
Chlorpyrifos	<25%	80-115	90%
Coumaphos	<25%	75-147	90%
Demeton-0	<25%	60-120	90%
Demeton-S	<25%	60-120	90%
Diazinon	<25%	60-120	90%
Dichlorvos	<25%	65-120	90%
Disulfoton	<25%	65-120	90%
Ethoprop	<25%	85-115	90%
Fensulfothion	<25%	60-145	90%
Fenthion	<25%	60-120	90%
Merphos	<25%	75-125	90%
Mevinphos	<25%	60-120	90%
Naled	<25%	60-120	90%
Parathion methyl	<25%	80-120	90%
Phorate	<25%	60-120	90%
Ronnel	<25%	80-120	90%
Stirophos (Tetrachlorvinphos)	<25%	60-120	90%
Tokuthion (Prothiofos)	<25%	60-120	90%
Trichloronate	<25%	60-150	90%

**TABLE 2-38**  
**METHOD 8140 Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Azinphos methyl	<30%	30-130	90%
Bolstar	<30%	60-140	90%
Chlorpyrifos	<30%	65-140	90%
Coumaphos	<30%	65-140	90%
Demeton-0	<30%	60-140	90%
Demeton-S	<30%	60-140	90%
Diazinon	<30%	60-140	90%
Dichlorvos	<30%	65-140	90%
Disulfoton	<30%	60-140	90%
Ethoprop	<30%	75-140	90%
Fensulfothion	<30%	60-140	90%
Fenthion	<30%	60-140	90%
Merphos	<30%	75-140	90%
Mevinphos	<30%	60-140	90%
Naled	<30%	60-140	90%
Parathion methyl	<30%	75-140	90%
Phorate	<30%	60-140	90%
Ronnel	<30%	75-140	90%
Stirophos (Tetrachlorvinphos)	<30%	60-140	90%
Tokuthion (Prothiofos)	<30%	60-140	90%
Trichloronate	<30%	60-140	90%

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

TABLE 2-39  
 METHOD 8141A Aqueous Level III B Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Azinphos methyl	<20%	60-140	90%
Bolstar (Sulprofos)	<20%	60-140	90%
Chlorpyrifos	<20%	60-140	90%
Coumaphos	<20%	75-125	90%
Demeton, O, S	<20%	60-140	90%
Diazinon	<20%	70-140	90%
Dichlorvos	<20%	70-130	90%
Dimethoate	<20%	60-140	90%
Disulfoton	<20%	75-125	90%
EPN	<20%	75-125	90%
Ethoprop	<20%	75-125	90%
Fensulfothion	<20%	70-130	90%
Fenthion	<20%	60-140	90%
Malathion	<20%	80-120	90%
Merphos	<20%	70-130	90%
Mevinphos	<20%	60-140	90%
Monocrotophos	<20%	60-140	90%
Naled	<20%	60-140	90%
Parathion-ethyl	<20%	80-120	90%
Parathion-methyl	<20%	60-140	90%
Phorate	<20%	75-125	90%
Ronnel	<20%	75-125	90%
Sulfotep	<20%	75-125	90%
TEPP	<20%	60-140	90%
Tetrachlorovinphos	<20%	75-125	90%
Tokuthion (Protothiofos)	<20%	60-140	90%
Trichloronate	<20%	60-140	90%

**TABLE 2-40**  
**METHOD 8141A Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Azinphos methyl	<25%	60-140	90%
Bolstar (Sulprofos)	<25%	60-140	90%
Chlorpyrifos	<25%	60-140	90%
Coumaphos	<25%	65-135	90%
Demeton, O, S	<25%	60-140	90%
Diazinon	<25%	60-140	90%
Dichlorvos	<25%	50-140	90%
Dimethoate	<25%	60-140	90%
Disulfoton	<25%	60-140	90%
EPN	<25%	70-130	90%
Ethionop	<25%	60-140	90%
Fensulfothion	<25%	70-130	90%
Fenthion	<25%	50-140	90%
Malathion	<25%	70-130	90%
Merphos	<25%	60-140	90%
Mevinphos	<25%	60-140	90%
Monocrotophos	<25%	50-140	90%
Naled	<25%	50-140	90%
Parathion-ethyl	<25%	60-140	90%
Parathion-methyl	<25%	60-140	90%
Phorate	<25%	60-140	90%
Ronnel	<25%	70-130	90%
Sulfotep	<25%	60-140	90%
TEPP	<25%	50-140	90%
Tetrachlorovinphos	<25%	60-140	90%
Tokuthion (Prothiofos)	<25%	60-140	90%
Trichloronate	<25%	60-140	90%

**TABLE 2-41**  
**METHOD 8150B Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
2,4-D	<20%	65-130	90%
Dalapon	<20%	60-130	90%
2,4-DB	<20%	80-120	90%
Dicamba	<20%	70-130	90%
Dichlorprop	<20%	70-130	90%
Dinoseb	<20%	80-120	90%
MCPA	<20%	70-130	90%
MCPP	<20%	80-120	90%
2,4,5-T	<20%	75-125	90%
2,4,5-TP	<20%	75-125	90%

**TABLE 2-42**  
**METHOD 8150B Solid Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
2,4-D	<25%	60-140	90%
Dalapon	<25%	60-140	90%
2,4-DB	<25%	60-140	90%
Dicamba	<25%	60-140	90%
Dichlorprop	<25%	60-140	90%
Dinoseb	<25%	60-140	90%
MCPA	<25%	60-140	90%
MCPP	<25%	60-140	90%
2,4,5-T	<25%	60-140	90%
2,4,5-TP	<25%	60-140	90%

- a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

**TABLE 2-43**  
**METHOD 8151 Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acifluorfen	<20%	75-150	90%
Bentazon	<20%	70-150	90%
Chloramben	<20%	65-140	90%
2,4-D	<20%	60-140	90%
Dalapon	<20%	60-140	90%
2,4-DB	<20%	60-140	90%
DCPA diacid	<20%	60-130	90%
Dicamba	<20%	60-140	90%
3,5-Dichlorobenzoic acid	<20%	60-140	90%
Dichlorprop	<20%	60-140	90%
Dinoseb	<20%	60-140	90%
5-Hydroxydicamba	<20%	70-130	90%
MCPP	<20%	60-140	90%
MCPA	<20%	60-140	90%
4-Nitrophenol	<20%	60-140	90%
Pentachlorophenol	<20%	60-140	90%
Picloram	<20%	60-135	90%
2,4,5-T	<20%	65-135	90%
2,4,5-TP	<20%	60-140	90%

**TABLE 2-44**  
**METHOD 8151 Solid Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acifluorfen	<25%	75-150	90%
Bentazon	<25%	70-140	90%
Chloramben	<25%	65-140	90%
2,4-D	<25%	60-140	90%
Dalapon	<25%	60-140	90%
2,4-DB	<25%	60-140	90%
DCPA diacid	<25%	60-140	90%
Dicamba	<25%	60-140	90%
3,5-Dichlorobenzoic acid	<25%	60-140	90%
Dichlorprop	<25%	50-150	90%
Dinoseb	<25%	60-130	90%
5-Hydroxydicamba	<25%	60-130	90%
MCPP	<25%	60-140	90%
MCPA	<25%	60-140	90%
4-Nitrophenol	<25%	60-140	90%
Pentachlorophenol	<25%	60-140	90%
Picloram	<25%	60-135	90%
2,4,5-T	<25%	65-140	90%
2,4,5-TP	<25%	60-140	90%

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

Compound	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Benzene	<20%	74-120	90%
Bromobenzene	<20%	78-122	90%
Bromochloromethane	<20%	64-121	90%
Bromodichloromethane	<20%	70-120	90%
Bromoform	<20%	75-126	90%
Bromomethane	<20%	62-128	90%
n-Butylbenzene	<20%	70-130	90%
sec-Butylbenzene	<20%	70-130	90%
tert-Butylbenzene	<20%	73-131	90%
Carbon tetrachloride	<20%	50-120	90%
Chlorobenzene	<20%	74-122	90%
Chloroethane	<20%	53-125	90%
Chloroform	<20%	65-115	90%
Chloromethane	<20%	57-129	90%
2-Chlorotoluene	<20%	65-115	90%
4-Chlorotoluene	<20%	66-132	90%
1,2-Dibromo-3-chloropropane	<20%	40-140	90%
Dibromochloromethane	<20%	64-120	90%
1,2-Dibromoethane	<20%	86-118	90%
Dibromomethane	<20%	77-122	90%
1,2-Dichlorobenzene	<20%	68-118	90%
1,3-Dichlorobenzene	<20%	71-127	90%
1,4-Dichlorobenzene	<20%	77-129	90%
Dichlorodifluoromethane	<20%	60-121	90%
1,1-Dichloroethane	<20%	75-117	90%
1,2-Dichloroethane	<20%	73-117	90%
1,1-Dichloroethene	<20%	67-121	90%
cis-1,2-Dichloroethene	<20%	74-128	90%
trans-1,2-Dichloroethene	<20%	71-116	90%
1,2-Dichloropropane	<20%	73-121	90%
1,3-Dichloropropane	<20%	72-120	90%
2,2-Dichloropropane	<20%	40-140	90%
1,1-Dichloropropene	<20%	62-134	90%
Ethylbenzene	<20%	65-133	90%
Hexachlorobutadiene	<20%	73-127	90%
Isopropylbenzene	<20%	70-130	90%
p-Isopropyltoluene	<20%	72-128	90%
Methylene chloride	<20%	73-117	90%
Naphthalene	<20%	71-137	90%
n-Propylbenzene	<20%	77-123	90%
Styrene	<20%	73-131	90%
1,1,1,2-Tetrachloroethane	<20%	63-120	90%
1,1,1,2,2-Tetrachloroethane	<20%	66-120	90%
Tetrachloroethene	<20%	62-120	90%
Toluene	<20%	70-134	90%
1,2,3-Trichlorobenzene	<20%	75-143	90%
1,2,4-Trichlorobenzene	<20%	75-141	90%
1,1,1-Trichloroethane	<20%	66-130	90%
1,1,2-Trichloroethane	<20%	74-133	90%
Trichloroethene	<20%	61-119	90%
Trichlorofluoromethane	<20%	57-122	90%
1,2,3-Trichloropropane	<20%	50-160	90%
1,2,4-Trimethylbenzene	<20%	67-131	90%
1,3,5-Trimethylbenzene	<20%	62-122	90%
Vinyl chloride	<20%	71-127	90%
o-Xylene	<20%	74-132	90%
m-Xylene	<20%	71-123	90%
p-Xylene	<20%	73-135	90%

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

TABLE 2-46  
 METHOD 8240B.8260A Solids Level III H Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Benzene	<30%	60-140	90%
Bromobenzene	<30%	60-140	90%
Bromochloromethane	<30%	60-140	90%
Bromodichloromethane	<30%	60-140	90%
Bromoform	<30%	60-140	90%
Bromomethane	<30%	60-140	90%
n-Butylbenzene	<30%	60-140	90%
sec-Butylbenzene	<30%	60-140	90%
tert-Butylbenzene	<30%	60-140	90%
Carbon tetrachloride	<30%	40-140	90%
Chlorobenzene	<30%	60-140	90%
Chloroethane	<30%	40-140	90%
Chloroform	<30%	50-140	90%
Chloromethane	<30%	50-140	90%
2-Chlorotoluene	<30%	50-140	90%
4-Chlorotoluene	<30%	50-140	90%
1,2-Dibromo-3-chloropropane	<30%	40-140	90%
Dibromochloromethane	<30%	50-140	90%
1,2-Dibromoethane	<30%	60-140	90%
Dibromomethane	<30%	60-140	90%
1,2-Dichlorobenzene	<30%	50-140	90%
1,3-Dichlorobenzene	<30%	50-140	90%
1,4-Dichlorobenzene	<30%	60-140	90%
Dichlorodifluoromethane	<30%	50-140	90%
1,1-Dichloroethane	<30%	60-140	90%
1,2-Dichloroethane	<30%	60-140	90%
1,1-Dichloroethene	<30%	50-140	90%
cis-1,2-Dichloroethene	<30%	60-140	90%
trans-1,2-Dichloroethene	<30%	60-140	90%
1,2-Dichloropropane	<30%	60-140	90%
1,3-Dichloropropane	<30%	60-140	90%
2,2-Dichloropropane	<30%	40-140	90%
1,1-Dichloropropene	<30%	50-140	90%
Ethylbenzene	<30%	50-140	90%
Hexachlorobutadiene	<30%	60-140	90%
Isopropylbenzene	<30%	60-140	90%
p-Isopropyltoluene	<30%	60-140	90%
Methylene chloride	<30%	60-140	90%
Naphthalene	<30%	60-140	90%
n-Propylbenzene	<30%	60-140	90%
Styrene	<30%	60-140	90%
1,1,1,2-Tetrachloroethane	<30%	50-140	90%
1,1,2,2-Tetrachloroethane	<30%	50-140	90%
Tetrachloroethene	<30%	50-140	90%
Toluene	<30%	60-140	90%
1,2,3-Trichlorobenzene	<30%	60-140	90%
1,2,4-Trichlorobenzene	<30%	60-140	90%
1,1,1-Trichloroethane	<30%	50-140	90%
1,1,2-Trichloroethane	<30%	60-140	90%
Trichloroethene	<30%	50-140	90%
Trichlorofluoromethane	<30%	40-140	90%
1,2,3-Trichloropropane	<30%	40-140	90%
1,2,4-Trimethylbenzene	<30%	50-140	90%
1,3,5-Trimethylbenzene	<30%	50-140	90%
Vinyl chloride	<30%	60-140	90%
o-Xylene	<30%	60-140	90%
m-Xylene	<30%	60-140	90%
p-Xylene	<30%	60-140	90%

a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

TABLE 2-47 (Page 1 of 2)  
 METHOD 8250A/8270B Aqueous Level III B Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acenaphthene	<5%	76-116	90%
Acenaphthylene	<5%	66-112	90%
Aldrin	<5%	60-115	90%
Anthracene	<5%	60-115	90%
Benzo(a)anthracene	<5%	65-115	90%
Chloroethane	<5%	83-115	90%
Benzo(b)fluoranthene	<5%	64-119	90%
Benzo(k)fluoranthene	<5%	60-120	90%
Benzo(a)pyrene	<5%	60-120	90%
Benzo(g,h,i)perylene	<5%	60-148	90%
Butyl benzyl phthalate	<5%	60-140	90%
beta-BHC	<5%	60-115	90%
gamma-BHC	<5%	50-150	90%
Bis(2-chloroethyl)ether	<5%	60-125	90%
Bis(2-chloroethoxy)methane	<5%	75-140	90%
Bis(2-chloroisopropyl)ether	<5%	75-125	90%
Bis(2-ethylhexyl)phthalate	<5%	60-130	90%
4-Bromophenyl phenyl ether	<5%	75-120	90%
2-Chloronaphthalene	<5%	77-120	90%
4-Chlorophenyl phenyl ether	<5%	70-120	90%
Chrysene	<5%	62-125	90%
4,4'-DDD	<5%	60-140	90%
4,4'-DDE	<5%	60-140	90%
4,4'-DDT	<5%	60-140	90%
Dibenz(a,h)anthracene	<5%	60-140	90%
Di-n-butylphthalate	<5%	60-140	90%
1,2-Dichlorobenzene	<5%	60-140	90%
1,3-Dichlorobenzene	<5%	60-140	90%
1,4-Dichlorobenzene	<5%	60-140	90%
3,3'-Dichlorobenzidine	<5%	60-165	90%

a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

TABLE 2-47 (Page 2 of 2)  
 METHOD 8250A/8270B Aqueous Level III B Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Dieldrin	<25%	60-140	90%
Diethylphthalate	<25%	60-140	90%
Dimethylphthalate	<25%	60-150	90%
2,4-Dinitrotoluene	<25%	68-120	90%
2,6-Dinitrotoluene	<25%	75-125	90%
Di-n-octylphthalate	<25%	60-135	90%
Endosulfan sulfate	<25%	50-150	90%
Endrin aldehyde	<25%	60-140	90%
Fluoranthene	<25%	60-140	90%
Fluorene	<25%	75-125	90%
Heptachlor	<25%	50-130	90%
Heptachlor epoxide	<25%	65-125	90%
Hexachlorobenzene	<25%	60-140	90%
Hexachlorobutadiene	<25%	60-130	90%
Hexachloroethane	<25%	60-130	90%
Indeno(1,2,3-cd)pyrene	<25%	60-140	90%
Isophorone	<25%	75-150	90%
Naphthalene	<25%	60-130	90%
Nitrobenzene	<25%	75-135	90%
N-Nitrosodi-n-propylamine	<25%	60-150	90%
PCB-1260	<25%	60-140	90%
Phenanthrene	<25%	70-120	90%
Pyrene	<25%	70-125	90%
1,2,4-Trichlorobenzene	<25%	74-120	90%
4-Chloro-3-methylphenol	<25%	60-130	90%
2-Chlorophenol	<25%	75-120	90%
2,4-Dichlorophenol	<25%	75-120	90%
2,4-Dimethylphenol	<25%	65-140	90%
2,4-Dinitrophenol	<25%	65-140	90%
2-Methyl-4,6-dinitrophenol	<25%	65-140	90%
2-Nitrophenol	<25%	60-160	90%
4-Nitrophenol	<25%	50-140	90%
Pentachlorophenol	<25%	67-125	90%
Phenol	<25%	60-140	90%
2,4,6-Trichlorophenol	<25%	65-135	90%

a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

TABLE 2-48 (Page 1 of 2)  
 METHOD 8250A/8270B Solids Level III B Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acenaphthene	<30%	60-140	90%
Acenaphthylene	<30%	60-140	90%
Aldrin	<30%	60-140	90%
Anthracene	<30%	60-140	90%
Benzo(a)anthracene	<30%	60-140	90%
Chloroethane	<30%	60-140	90%
Benzo(b)fluoranthene	<30%	60-140	90%
Benzo(k)fluoranthene	<30%	60-140	90%
Benzo(a)pyrene	<30%	60-140	90%
Benzo(g,h,i)perylene	<30%	60-140	90%
Buryl benzyl phthalate	<30%	60-140	90%
beta-BHC	<30%	50-140	90%
gamma-BHC	<30%	60-140	90%
Bis(2-chloroethyl)ether	<30%	60-140	90%
Bis(2-chloroethoxy)methane	<30%	60-140	90%
Bis(2-chloroisopropyl)ether	<30%	60-140	90%
Bis(2-ethylhexyl)phthalate	<30%	60-140	90%
4-Bromophenyl phenyl ether	<30%	60-140	90%
2-Chloronaphthalene	<30%	60-140	90%
4-Chlorophenyl phenyl ether	<30%	60-140	90%
Chrysene	<30%	60-140	90%
4,4'-DDD	<30%	50-140	90%
4,4'-DDE	<30%	50-140	90%
4,4'-DDT	<30%	50-140	90%
Dibenz(a,h)anthracene	<30%	50-140	90%
Di-n-butylphthalate	<30%	50-140	90%
1,2-Dichlorobenzene	<30%	60-140	90%
1,3-Dichlorobenzene	<30%	60-140	90%
1,4-Dichlorobenzene	<30%	60-140	90%
3,3'-Dichlorobenzidine	<30%	60-140	90%

a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

TABLE 2-48 (Page 2 of 2)  
 METHOD 8250A/8270B Solids Level III B Objectives

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Dieldrin	<30%	60-140	90%
Drethvlothalate	<30%	60-140	90%
Dimethylphthalate	<30%	60-140	90%
2,4-Dinitrotoluene	<30%	60-140	90%
2,6-Dinitrotoluene	<30%	60-140	90%
Di-n-octylphthalate	<30%	60-140	90%
Endosulfan sulfate	<30%	60-140	90%
Endrin aldehyde	<30%	60-140	90%
Fluoranthene	<30%	50-140	90%
Fluorene	<30%	60-140	90%
Heptachlor	<30%	60-140	90%
Heptachlor epoxide	<30%	60-140	90%
Hexachlorobenzene	<30%	50-140	90%
Hexachlorobutadiene	<30%	50-140	90%
Hexachloroethane	<30%	50-140	90%
Indenof (1,2,3-cd)pyrene	<30%	50-140	90%
Isophorone	<30%	60-140	90%
Naphthalene	<30%	50-140	90%
Nitrobenzene	<30%	60-140	90%
N-Nitrosodi-n-propylamine	<30%	50-140	90%
PCB-1260	<30%	50-140	90%
Phenanthrene	<30%	60-140	90%
Pyrene	<30%	60-140	90%
1,2,4-Trichlorobenzene	<30%	60-140	90%
4-Chloro-3-methylphenol	<30%	60-140	90%
2-Chlorophenol	<30%	60-140	90%
2,4-Dichlorophenol	<30%	60-140	90%
2,4-Dimethylphenol	<30%	60-140	90%
2,4-Dinitrophenol	<30%	60-140	90%
2-Methyl-4,6-dinitrophenol	<30%	50-140	90%
2-Nitrophenol	<30%	60-140	90%
4-Nitrophenol	<30%	60-140	90%
Pentachlorophenol	<30%	60-140	90%
Phenol	<30%	50-140	90%
2,4,6-Trichlorophenol	<30%	60-140	90%

a Relative Percent Difference of Duplicate Sample analyses  
 b Percent Recovery of Spike Sample analyses

**TABLE 2-49**  
**METHOD 8310 Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acenaphthene	<25%	55-140	90%
Acenaphthylene	<25%	60-140	90%
Anthracene	<25%	60-140	90%
Benzo(a)anthracene	<25%	65-140	90%
Benzo(a)pyrene	<25%	55-140	90%
Benzo(b)fluoranthene	<25%	65-140	90%
Benzo(ghi)perylene	<25%	55-140	90%
Benzo(k)fluoranthene	<25%	55-140	90%
Chrysene	<25%	55-140	90%
Dibenzo(a,h)anthracene	<25%	55-140	90%
Fluoranthrene	<25%	65-140	90%
Fluorene	<25%	60-140	90%
Indeno(1,2,3-cd)pyrene	<25%	60-140	90%
Naphthalene	<25%	60-140	90%
Phenanthrene	<25%	55-140	90%
Pyrene	<25%	65-140	90%

**TABLE 2-50**  
**METHOD 8310 Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acenaphthene	<30%	50-150	90%
Acenaphthylene	<30%	55-150	90%
Anthracene	<30%	55-150	90%
Benzo(a)anthracene	<30%	60-140	90%
Benzo(a)pyrene	<30%	50-150	90%
Benzo(b)fluoranthene	<30%	60-140	90%
Benzo(ghi)perylene	<30%	50-140	90%
Benzo(k)fluoranthene	<30%	50-150	90%
Chrysene	<30%	50-150	90%
Dibenzo(a,h)anthracene	<30%	50-150	90%
Fluoranthrene	<30%	60-140	90%
Fluorene	<30%	60-150	90%
Indeno(1,2,3-cd)pyrene	<30%	60-150	90%
Naphthalene	<30%	60-150	90%
Phenanthrene	<30%	50-150	90%
Pyrene	<30%	60-140	90%

**TABLE 2-51**  
**METHOD 8315 Aqueous Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Formaldehyde	<30%	70 - 125	90
Acetaldehyde	<30%	60 - 120	90

**TABLE 2-52**  
**METHOD 8315 Solids Level III B Objectives**

Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Formaldehyde	<30%	60 - 125	90
Acetaldehyde	<30%	60 - 125	90

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

TABLE 2-53 METHOD 8316 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acrylamide	<20%	65-135	90%
Acrylonitrile	<20%	65-135	90%
Acrolein (Propenal)	<20%	65-135	90%

TABLE 2-54 METHOD 8316 Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Acrylamide	<5%	60-140	90%
Acrylonitrile	<5%	60-140	90%
Acrolein (Propenal)	<5%	60-140	90%

TABLE 2-55 METHOD 8318 Aqueous Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Aldicarb Sulfone	<20%	65-140	90%
Methomyl (Lannate)	<20%	70-135	90%
3-Hydroxycarbofuran	<20%	60-140	90%
Dioxacarb	<20%	70-135	90%
Aldicarb (Temik)	<20%	65-140	90%
Propoxur (Baygon)	<20%	65-140	90%
Carbofuran (Furadan)	<20%	70-135	90%
Carbaryl (Sevin)	<20%	70-135	90%
Methiocarb (Mesuroi)	<20%	65-140	90%
Promecarb	<20%	65-140	90%

TABLE 2-56 METHOD 8318 Solids Level III B Objectives			
Compound	Precision (RPD) <sup>a</sup>	Accuracy (%Recovery) <sup>b</sup>	Completeness (%)
Aldicarb Sulfone	<25%	65-140	90%
Methomyl (Lannate)	<25%	60-140	90%
3-Hydroxycarbofuran	<25%	65-145	90%
Dioxacarb	<25%	60-140	90%
Aldicarb (Temik)	<25%	60-140	90%
Propoxur (Baygon)	<25%	60-140	90%
Carbofuran (Furadan)	<25%	65-145	90%
Carbaryl (Sevin)	<25%	65-145	90%
Methiocarb (Mesuroi)	<25%	60-140	90%
Promecarb	<25%	60-145	90%

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

**TABLE 2 - 57**  
**INORGANIC Aqueous Level III B Objectives**

Analyte	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Aluminum	<20%	80-120	90%
Antimony	<20%	80-120	90%
Arsenic	<20%	80-120	90%
Barium	<20%	80-120	90%
Beryllium	<20%	80-120	90%
Cadmium	<20%	80-120	90%
Calcium	<20%	80-120	90%
Chromium	<20%	80-120	90%
Cobalt	<20%	80-120	90%
Copper	<20%	80-120	90%
Iron	<20%	80-120	90%
Lead	<20%	80-120	90%
Magnesium	<20%	80-120	90%
Manganese	<20%	80-120	90%
Mercury	<20%	80-120	90%
Nickel	<20%	80-120	90%
Potassium	<20%	80-120	90%
Selenium	<20%	80-120	90%
Silver	<20%	80-120	90%
Sodium	<20%	80-120	90%
Thallium	<20%	80-120	90%
Vanadium	<20%	80-120	90%
Zinc	<20%	80-120	90%
Cyanide	<20%	80-120	90%

**TABLE 2 - 58**  
**INORGANIC Solids Level III B Objectives**

Analyte	Precision (RPD) <sup>a</sup>	Accuracy (% Recovery) <sup>b</sup>	Completeness (%)
Aluminum	<30%	70-130	90%
Antimony	<30%	70-130	90%
Arsenic	<30%	70-130	90%
Barium	<30%	70-130	90%
Beryllium	<30%	70-130	90%
Cadmium	<30%	70-130	90%
Calcium	<30%	70-130	90%
Chromium	<30%	70-130	90%
Cobalt	<30%	70-130	90%
Copper	<30%	70-130	90%
Iron	<30%	70-130	90%
Lead	<30%	70-130	90%
Magnesium	<30%	70-130	90%
Manganese	<30%	70-130	90%
Mercury	<30%	70-130	90%
Nickel	<30%	70-130	90%
Potassium	<30%	70-130	90%
Selenium	<30%	70-130	90%
Silver	<30%	70-130	90%
Sodium	<30%	70-130	90%
Thallium	<30%	70-130	90%
Vanadium	<30%	70-130	90%
Zinc	<30%	70-130	90%
Cyanide	<30%	70-130	90%

<sup>a</sup> Relative Percent Difference of Duplicate Sample analyses  
<sup>b</sup> Percent Recovery of Spike Sample analyses

### 3.0 SAMPLE CONTAINERS

Most environmental sampling and analytical applications offer numerous opportunities for sample contamination. For this reason, contamination is a common source of error in environmental measurements. The sample container itself represents one such source of sample contamination. Therefore, the specifications and guidance for the preparation of contaminant-free sample containers has been prepared to assist the Program participants in obtaining sample containers from vendors or to assist the laboratories providing the sample containers to prepare contaminant free sample containers. The specifications and guidance are designed to minimize contamination which could affect subsequent analytical determinations. Most analysis activities require all component materials (caps, liners, septa, packaging materials, etc) provided by the bottle preparer to meet or exceed the criteria limits of bottle specifications listed within this section.

#### 3.1 SAMPLE CONTAINER AND COMPONENT MATERIAL GUIDELINES

A variety of factors affect the choice of containers and cap material for each bottle type. These include resistance to breakage, size, weight, interferences with target analytes, cost, and availability.

Container types A through L in Table 3-1 are the type of sample containers that have been successfully used in the past. Kimax or Pyrex brand borosilicate glass is inert to most materials and is recommended where glass containers are used (i.e., pesticides and other organics). Conventional polyethylene is recommended when plastic is acceptable because of reasonable cost and less absorption of metal ions. The specific sampling situation will determine the use of plastic or glass.

#### 3.2 MAXIMUM CONTAMINANT LEVEL SPECIFICATIONS FOR SAMPLE CONTAINERS

For inorganic sample containers, the Required Quantitation Limits (RQLs) listed in Table 3-2 are the guidelines for maximum trace metal contamination. Concentration at or above these limits on any parameter should preclude these containers from use in collecting inorganic samples. Table 3-2 applies only to the preparation of sample containers, it does not apply to the analysis of samples for any Site Remediation Program site investigation.

The RQL guidelines for organic sample containers are listed in Table 3-2. When the RQL in Table 3-2 is multiplied by the appropriate factor listed below, the resulting value then represents the maximum concentration guidelines for particular sample containers based on organic sample sizes for routine analyses. Table 3-2 applies only to the preparation of sample containers, it does not apply to the analysis of samples for any Site Remediation Program site investigation.

<u>Container type</u>	<u>Multiple of RQL</u>
A	1.0
B	0.5
D	10.0
E	8.0
F	4.0
G	2.0
H	0.5
J	0.5
K	2.0

### 3.3 SAMPLE CONTAINER PREPARATION CLEANING PROCEDURES

The purpose of this Section is to provide guidance on cleaning procedures for preparing contaminant-free sample containers. In selecting cleaning procedures for sample containers, it is important to consider all of the parameters of interest. Although a given cleaning procedure may be effective for one parameter or type of analysis it may be ineffective for another. When multiple determinations are performed on a single sample or on a subsample from a single container, a cleaning procedure may actually be a source of contamination for some analytes while minimizing contamination in others. It should be the responsibility of the bottle supplier to verify that the cleaning procedures actually used satisfy the quality control requirements set forth in Section 3.4.

#### 3.3.1 Cleaning Procedure for Container Types: A, E, F, G, H, J, K

Sample Type: Extractable Organics (Types A, E, F, G, H, J and K); and Metals (Types E, F, G, and J) in Soils and Water.

- a. Wash glass bottles, teflon liners, and caps with hot tap water using laboratory grade nonphosphate detergent.
- b. Rinse three times with tap water to remove detergent.
- c. Rinse with 1:1 nitric acid (reagent grade HNO<sub>3</sub>, diluted with ASTM Type I deionized water).
- d. Rinse three times with ASTM Type I organic free water.
- e. Oven dry bottles, liners and caps at 105° - 125°C for one hour.
- f. Rinse with pesticide grade hexane or pesticide grade methylene chloride using 20 mL for 1/2 gallon container; 10 mL for 32-oz and 16- oz containers; and 5 mL for 8-oz and 4-oz containers.
- g. Oven dry bottles, liners and caps at 105° - 125°C for one hour.
- h. Allow bottles, liners, and caps to cool to room temperature in an enclosed contaminant-free environment.
- i. Place liners in lids and cap containers.
- j. Label each container with Lot number and pack in case.
- k. Label exterior of each case with Lot number.
- l. Store in contaminant-free area.

#### 3.3.2 Cleaning Procedure for Container Types: B, D

Sample Type: Purgeable (Volatile) Organics.

- a. Wash glass vials, teflon-backed septa, teflon liners and caps in hot water using laboratory grade nonphosphate detergent.
- b. Rinse three times with tap water.
- c. Rinse three times with ASTM Type I organic-free water.
- d. Oven dry vials, caps, septa and liners at 105°C for one hour.
- e. Allow vials, caps, septa and liners to cool to room temperature in an enclosed contaminant-free environment.
- f. Seal 40 mL vials with septa (teflon side down) and cap.
- g. Place liners in lids and cap 120 mL vials.
- h. Label each vial with Lot number and pack in case.
- i. Label exterior of each case with Lot number.
- j. Store in contaminant-free area.

### 3.3.3 Cleaning Procedure for Container Types: C, L

Sample Type: Metals, Cyanide, and Sulfide.

- a. Wash polyethylene bottles and caps in hot tap water using laboratory grade nonphosphate detergent.
- b. Rinse three times with tap water.
- c. Rinse with 1:1 nitric acid (reagent grade HNO<sub>3</sub>, diluted with ASTM Type I deionized water).
- d. Rinse three times with ASTM Type I deionized water.
- e. Invert and air dry in contaminant-free environment.
- f. Cap bottles.
- g. Label each container with Lot number and pack in case.
- h. Label exterior of each case with Lot number.
- i. Store in contaminant-free area.

## 3.4 SAMPLE CONTAINER QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES

The two aspects of quality assurance (e.g., quality control and quality assessment) must be applied to sample containers as well as to the analytical measurements. Quality control includes the application of good laboratory practices and standard operating procedures especially designed for the cleaning of sample containers. The cleaning operation should be based on protocols especially designed for specific contaminant problems. Strict adherence to these cleaning protocols is imperative.

Quality assessment of the cleaning process depends largely on monitoring for adherence to the protocols. Because of their critical role in the quality assessment of the cleaning operation, protocols must be carefully designed and followed. Guidance is provided in this section on design and implementation of quality assurance and quality control protocols.

### 3.4.1 Quality Assurance

Major QA/QC activities should include the inspection of all incoming materials, QC analysis of cleaned lots of containers, and monitoring of the container storage area. Complete documentation of all QC inspection results (acknowledging acceptance or rejection) should be kept as part of the permanent bottle preparation files. QA/QC records (i. e., preparation/QC logs, analytical data, data tapes, storage log) should also be stored in a central location within the facility.

#### 3.4.1.1 Incoming Materials Inspection

A representative item from each case of containers should be checked for conformance with specifications provided in Section Table 3-1. Any deviation should be considered unacceptable.

#### 3.4.1.2 Quality Control Inspection of Cleaned Lots of Containers

Following container cleaning and labeling, two containers should be selected from each container lot to be used for QC purposes. The two categories of QC containers should be as follows:

##### A. Analysis QC Containers

One QC container per lot should be designated as the Analysis QC Container. The sample container preparer should analyze the Analysis QC Container(s) to check for contamination prior to releasing the associated container lot for use. The QC analyses procedures specified in the Quality Control Analysis part of this section for determining the presence of extractable and volatile organics, pesticides, metals, and cyanide should be utilized.

If the representative Analysis QC Container(s) passes QC inspection, the related lot of containers should be cleared for use and documentation of the QC inspection maintained.

If the representative Analysis QC Container(s) does not pass inspection per the specified QC Analysis procedures any container labels should be removed and the entire lot returned for reprocessing.

A laboratory standard and a blank should be run with each QC analysis. All QC analysis results should be kept in chronological order by QC report number in a central QC file. The QC numbers assigned should be documented in the preparation/QC log, indicating acceptance or rejection and date of analysis.

A container lot should not be released for shipment prior to QC analysis and clearance. Once the containers have passed QC inspection, the containers should be stored in a contaminant-free area until packaging and shipment.

#### B. Storage QC Containers:

One QC container per lot should be designated as the Storage QC Container. The Storage QC Container should be separated from the lot after cleaning and labeling and should be stored in a designated contaminant-free area. The date the container is placed in the storage area should be recorded in the storage QC container log.

The Storage QC Container should be removed periodically from the storage area and analyzed using the QC analysis procedures for that container type. Analysis of the Storage QC Container should be performed if contamination of the particular container lot comes into question at any time following shipment.

The designated storage area should be monitored continuously for volatile contaminants. A precleaned, 40 mL vial that has passed a QC inspection should be filled with ASTM Type I organic-free water and be placed in the storage area. This vial should be changed at one-week intervals. The removed vial should be subjected to analysis for volatile organics as described in the Quality Control Analysis part of this section. Any peaks indicate contamination. Identify contaminants, if present, and take appropriate corrective action.

### 3.4.2 Quality Control Analysis

The objectives of this section are to discuss techniques for the quality control (QC) analysis of sample containers to be used in conjunction with the cleaning procedures contained in Section 3.3

The types of QC analyses correlate with the types of containers being analyzed and their future use in sample collection. The QC analyses are intended for the determination of:

- Extractable organics and pesticides
- Volatile organics
- Metals
- Cyanide

QC analyses should be performed according to the container type and related sample type and utilize method(s) appropriate for the intended use of the sample containers and the quantitation limits contained in Table 3-2.

#### 3.4.2.1 Determination of Extractable Organics:

Container Types: A, E, F, G, H, J, and K

#### A. Sample Preparation

1. Add 60 mL of pesticide-grade methylene chloride to the container and shake for two minutes.
2. Transfer the solvent to a Kuderna-Danish (KD) apparatus equipped with a three-ball Snyder column. Concentrate to less than 10 mL on a steam bath.
3. Add 50 mL of pesticide-grade hexane to the KD apparatus by slowly pouring down through the Snyder column. Concentrate to less than 10 mL to effect solvent replacement of hexane for methylene chloride.
4. Concentrate the solvent to 1 mL using a micro-Snyder column.
5. Prepare a solvent blank by adding 60 mL of the rinse solvent used in step F of the cleaning procedure for container types A, E, F, G, H, J, and K (Section II) directly to a KD apparatus and proceed as above.

#### B. Extractable Organics Sample Analysis

1. Instrument calibration should be performed as described in the appropriate method for the intended use of the sample containers and the quantitation limits contained in Table 3-2.
2. Any peaks found in the container solvent that are not found in the solvent blank or with peak heights or areas not within +/- 50% of the blank peak height or area should be cause for rejection.
3. Identify and quantitate any contaminant(s) that cause rejection of a container Lot.
4. A blank should be run with each analysis.

### 3.4.2.2 Determination of Volatile Organics:

Container Types: B and D

#### A. Sample Preparation and Analysis

1. Fill the container with ASTM Type I organic-free water.
2. Instrument calibration should be performed as described in the method as appropriate for the intended use of the sample containers and the quantitation limits contained in Table 3-2.
3. Any peaks not found in the blank or with peak heights or areas not within  $\pm 50\%$  of the blank peak height or area should be cause for rejection.
4. Identify and quantitate any contaminant(s) that cause rejection of a container Lot.
5. A blank should be run with each analysis.

### 3.4.2.3 Determination of Metals:

Container Types: C, E, F, G, J, and L

#### A. Sample Preparation:

1. Add 50 mL of ASTM Type I deionized water to the container and acidify with 0.5 mL reagent-grade  $\text{HNO}_3$ . Cap and shake well.
2. Treat the sample as a dissolved metals sample. Analyze the undigested water.

#### B. Sample Analysis:

1. Instrument calibration should be performed as described in the appropriate method for the intended use of the sample containers and the quantitation limits contained in Table 3-2.
2. The rinse solution should be analyzed before use on the bottles that are designated for analysis to ensure that a contaminated solution is not used for rinsing the bottles.

### 3.4.2.4 Determination of Cyanide:

Container Types: C and L

A. Sample Preparation and Analysis:

1. Instrument calibration and sample analysis should be performed as described in the appropriate method. Cyanide should be determined by placing 250 mL of ASTM Type I deionized water in the container. Add 1.25 mL of 6N NaOH. Cap the container and shake vigorously for two minutes. Analyze an aliquot by the EPA method selected. The detection limit should be 10 ppb or lower.
2. A blank should be run by analyzing an aliquot of the ASTM Type I water used above.
3. The detection of contaminants of 10 ppb cyanide should be cause for rejection of the lot of containers. (Note: Contamination could be due to the container, the cap or the NaOH).

TABLE 3-1

SAMPLE CONTAINER RECOMMENDATIONS

CONTAINER TYPE	SPECIFICATIONS
A <u>Container:</u>	80 oz. amber glass, ring handle bottle/jug.
<u>Closure:</u>	black phenolic, baked polyethylene cap, 0.015 mm teflon liner.
B <u>Container:</u>	40 mL glass vial.
<u>Closure:</u>	black phenolic, open-top, screw cap.
<u>Septum:</u>	disc of .005 inch teflon bonded to .120 inch silicon for total thickness of 0.125 inch.
C <u>Container:</u>	1 liter high density polyethylene, cylinder-round bottle.
<u>Closure:</u>	white polyethylene, white ribbed, polyethylene liner.
D <u>Container:</u>	120 mL wide mouth, glass vial.
<u>Closure:</u>	white polypropylene cap, 0.015 mm teflon liner.
E <u>Container:</u>	16 oz tall, wide mouth, straight sided, flint glass jar.
<u>Closure:</u>	black phenolic, baked polyethylene cap, 0.15 mm teflon liner.
F <u>Container:</u>	8 oz. short, wide mouth, straight sided, flint glass jar.
<u>Closure:</u>	black phenolic, baked polyethylene cap, 0.030 mm teflon liner.
G <u>Container:</u>	4 oz. tall, Wide mouth, straight-sided, flint glass jar.
<u>Closure:</u>	black phenolic, baked polyethylene cap, 0.015 mm teflon liner.
H <u>Container:</u>	1 liter amber, Boston round glass bottle, pour-out neck finish.
<u>Closure:</u>	black phenolic, baked polyethylene cap, 0.015 mm teflon liner.
J <u>Container:</u>	32 oz. tall, wide mouth, straight-sided, flint glass jar.
<u>Closure:</u>	black phenolic, baked polyethylene cap 0.015 mm teflon liner.
K <u>Container:</u>	4 liter amber glass, ring handle bottle/jug.
<u>Closure:</u>	black phenolic, baked polyethylene cap, 0.015 mm teflon liner.
L <u>Container:</u>	500 mL high-density polyethylene, cylinder-round bottle.
<u>Closure:</u>	white polyethylene cap, white ribbed, polyethylene liner.

Table 3-2  
Organic Analyte Sample Container Specifications and  
Required Quantitation Limits

<u>Volatile Compound</u>	<u>Water (µg/L)</u>
Chloromethane	1
Bromomethane	1
Vinyl Chloride	1
Chloroethane	1
Methylene Chloride	2
Acetone	5
Carbon Disulfide	1
1,1-Dichloroethene	1
1,1-Dichloroethane	1
1,2-Dichloroethene (total)	1
Chloroform	1
1,2-Dichloroethane	1
2-Butanone	5
1,1,1-Trichloroethane	1
Carbon Tetrachloride	1
Bromodichloromethane	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
Trichloroethene	1
Dibromochloromethane	1
1,1,2-Trichloroethane	1
Benzene	1
Trans-1,3-Dichloropropene	1
Bromoform	1
4-Methyl-2-pentanone	5
2-Hexanone	5
Tetrachloroethene	1
Toluene	1
1,1,2,2-Tetrachloroethane	1
Chlorobenzene	1
Ethyle Benzene	1
Styrene	1
Xylenes (total)	1

**Table 3-2  
 Organic Analyte Sample Container Specifications and  
 Required Quantitation Limits**

<u>Compound</u>	<u>Water (µg/L)</u>
Phenol	5
bis(2-Chloroethyl) ether	10
2-Chlorophenol	5
1,2-Dichlorobenzene	5
1,3-Dichlorobenzene	5
1,4-Dichlorobenzene	5
2-Methylphenol	5
2,2'-oxybis (1-chloropropane)	5
4-Methylphenol	5
N-Nitroso-di-n-propylamine	5
Hexachloroethane	5
Nitrobenzene	5
Isophorone	5
2-Nitrophenol	5
2,4-Dimethylphenol	5
bis(2-Chloroethoxy) methane	5
2,4-Dichlorophenol	5
1,2,4-Trichlorobenzene	5
Naphthalene	5
4-Chloroaniline	5
Hexachlorobutadiene	5
4-Chloro-3-methylphenol	5
2-Methylnaphthalene	5
Hexachlorocyclopentadiene	5
2,4,6-Trichlorophenol	5
2,4,5-Trichlorophenol	20
2-Chloronaphthalene	5
2-Nitroaniline	20
Dimethylphthalate	5
Acenaphthalene	5
2,6-dinitrotoluene	5
3-Nitroaniline	20
Acenaphthene	5
2,4-Dinitrophenol	20
4-Nitrophenol	20

**Table 3-2**  
**Organic Analyte Sample Container Specifications and**  
**Required Quantitation Limits**

<u>Semi-Volatile Compound</u>	<u>Water</u> <u>(ug/L)</u>
Dibenzofuran	5
2,4-Dinitrotoluene	5
Diethylphthalate	5
4-Chlorophenyl-phenyl ether	5
Flourene	5
4-Nitroaniline	20
4,6-Dinitro-2-methylphenol	20
N-nitrosodiphenylamine	5
4-Bromophenyl-phenyl ether	5
Hexachlorobenzene	5
pentachlorophenol	20
Phenanthrene	5
Anthracene	5
Carbazole	5
Di-n-butylphthalate	5
Fluoranthene	5
Pyrene	5
Butylbenzylphthalate	5
3,3'-Dichlorobenzidine	5
Benzo(a)anthracene	5
Chrysene	5
bis(2-Ethylhexyl)phthalate	5
Di-n-octylphthalate	5
Benzo(b)fluoranthene	5
Benzo(k)fluoranthene	5
Benzo(a)pyrene	5
Indeno(1,2,3-cd)pyrene	5
Dibenz(a,h)anthracene	5
Benzo(g,h,i)perylene	5

**Table 3-2**  
**Organic Analyte Sample Container Specifications and**  
**Required Quantitation Limits**

<u>Pesticide/PCBs</u>	<u>Water</u> <u>(ug/L)</u>
alpha-BHC	0.025
beta-BHC	0.025
delta-BHC	0.025
gamma-BHC	0.025
Heptachlor	0.025
Aldrin	0.025
Heptachlor epoxide	0.025
Endosulfan I	0.025
Dieldrin	0.05
4,4'-DDE	0.05
Endrin	0.05
Endosulfan II	0.05
4,4'-DDD	0.05
Endosulfan sulfate	0.05
4,4'-DDT	0.05
Methoxychlor	0.25
Endrin ketone	0.05
endrin aldehyde	0.05
alpha-Chlordane	0.025
gamma-Chlordane	0.025
Toxaphene	0.50
Aroclor - 1016	0.25
Aroclor - 1221	0.50
Aroclor - 1232	0.25
Aroclor - 1242	0.25
Aroclor - 1248	0.25
Aroclor - 1254	0.50
Aroclor - 1260	0.50

**Table 3-2  
Inorganic Analyte Sample Container Specifications and  
Required Quantitation Limits**

<u>Analyte</u>	<u>Water(<math>\mu\text{g/L}</math>)</u>
Aluminum	100
Antimony	10
Arsenic	1
Barium	20
Beryllium	1
Cadmium	2
Calcium	100
Chromium	10
Cobalt	10
Copper	10
Iron	100
Lead	2
Magnesium	100
Manganese	10
Mercury	0.2
Nickel	20
Potassium	100
Selenium	2
Silver	10
Sodium	100
Thallium	10
Vanadium	20
Zinc	20
Cyanide	10

## 4.0 SAMPLE CUSTODY, PRESERVATION, AND HOLDING TIMES

### 4.1 SAMPLE CUSTODY

It is IEPA Site Remediation Program recommendation to follow the sample custody protocols as described in "NEIC Policies and Procedures", EPA-330/9-78 DDI-R, Revised June 1985. For the laboratory this custody is in two parts: laboratory analysis, and documentation files. Files, including all originals of laboratory reports and purge files, should be maintained under document control in a secure area.

A sample, sample data, or documentation files is under your custody if they

1. are in your possession;
2. are in your view, after being in your possession;
3. are in your possession and you place them in a secured location; or
4. are in a designated secure area.

The laboratory should have custody procedures for sample receiving and log-in; sample storage; tracking during sample preparation and analysis; and storage of data which would allow the laboratory to demonstrate, if necessary, that sample and data custody as defined above was maintained.

### 4.2 PRESERVATION AND HOLDING TIMES

The laboratory must assure that the Preservation and Holding Time Criteria contained in the following table are met. Any deviations from the criteria by either the laboratory or the Program participant submitting samples to the laboratory must be noted in the laboratory's data reports. See Table 3-1 of this Analytical Quality Assurance Plan for detailed descriptions of the appropriate container types.

Analysis	Container Type	Preservatives	Holding Times
Volatile Organics	Glass	Cool to 4°C w/HCL to a pH<2	14 Days
Extractable Organics	Glass	Cool to 4°C	7 Days until extraction. 40 Days after extraction
Metals (except Hg)	Polyethylene or glass	HNO <sub>3</sub> to a pH<2	6 Months
Mercury	Polyethylene or glass	HNO <sub>3</sub> to a pH<2	28 Days
Cyanide	Polyethylene or glass	NaOH to a pH>12	14 Days

## 5.0 ANALYTICAL PROCEDURES AND CALIBRATIONS

This section of the Analytical Quality Assurance Plan covers the laboratory analytical procedures and calibration procedures to be used to obtain data for the Site Remediation Program (Program). All analytical procedures and calibrations are contained in the "USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition" with updates. The analytical and calibration procedures have been selected based upon the Program's two categories (A and B) of decisions and determinations and upon the Program's need to obtain data that meets or exceeds the objectives as previously described as data quality levels IIIA and IIIB. (See Section 2.0 of this document for a description of the categories and levels).

### 5.1 SAMPLE PREPARATION PROCEDURES

Prior to analysis samples must undergo an appropriate preparation procedure. This section lists the acceptable U.S.EPA sample digestion, extraction, and introduction procedures.

#### 5.1.1 Metallic Analytes

Prior to analysis, samples must be solubilized or digested using the appropriate method. When analyzing for dissolved constituents, acid digestion is not necessary if the samples are filtered at the time of collection followed by acid preservation. The USEPA SW-846 methods are, 1311, 3005A, 3010A, 3015, 3020A, 3040, 3050A, and 3051. When analyzing samples by Toxicity Characteristic Leaching Procedure (TCLP Method 1311) the TCLP extracts must also be prepared by the appropriate 3000 series method.

#### 5.1.2 Organic Analytes

##### 5.1.2.1 Extraction Procedures

Water and soil samples for base/neutral and acid extractables and organochlorine pesticides/PCBs must undergo solvent extraction prior to analysis. The method that should be used on a particular sample is highly dependent upon the physical characteristics of that sample. The USEPA SW-846 methods are 1311, 3510B, 3520B, 3540B, 3550B, and 3580B. When analyzing samples by Toxicity Characteristic Leaching Procedure (TCLP Method 1311) the TCLP extracts must also be prepared by the appropriate 3000 series method. Each category in Table 5-1, PREPARATION METHODS FOR ORGANIC ANALYTES, corresponds to the preparative methods available.

### 5.1.2.2 Direct Introduction Procedure

Water and soil samples for purgeable organics must undergo the technique of purge and trap for the introduction of purgeable organics into a gas chromatograph. The USEPA SW-846 method is 5030A.

### 5.1.2.3 Cleanup Procedures

Cleanup procedures employed are determined by the analytes of interest within the extract. Cleanup of a sample may be done exactly as instructed in the cleanup method for some of the analytes. However, there may be some instances where, in order to meet the Program data quality objectives, cleanup is performed using a modification of one of the procedures to optimize recovery and separation. In the event of cleanup modification the laboratory must retain sufficient documentation to demonstrate the necessity of and efficacy of the modifications. Extracts with components which interfere with spectral or chromatographic determinations are expected to be subjected to cleanup procedures. The USEPA SW-846 Cleanup Procedures are 3610, 3611, 3620, 3630, 3640, 3650, and 3660. Each category in Table 5-2, RECOMMENDED CLEANUP TECHNIQUES FOR INDICATED GROUPS OF COMPOUNDS, corresponds to the determinative methods available.

## 5.2 ANALYTICAL METHODS

Tables 1-1 through 1-4 list the analytical procedures to be used for the generation of data for Category A decisions and determinations. Table 1-5 lists the analytical procedures to be used for generation of data for Category B decisions and determinations. For all series 7000 methods the instructions on analysis contain in method 7000 must be followed in addition to those instructions contained in the individual methods. For all series 8000 methods the instructions on analysis contain in method 8000A must be followed in addition to those instructions contained in the individual methods.

## 5.3 CALIBRATION PROCEDURES AND FREQUENCIES

Calibration of laboratory equipment will be based on USEPA SW-846 procedures. Records of calibrations will be filed and maintained by the laboratory. These records will be filed at the location where the work is performed and will be subject to Agency audit.

### 5.3.1 Calibration for Organic Analyses by Gas Chromatograph

The recommended gas chromatographic columns and operating conditions for the instrument are specified in the USEPA SW-846 determinative method.

Establish gas chromatographic operating parameters equivalent to those indicated in Section 7.0 of the USEPA SW-846 determinative method of interest. Prepare calibration standards using the procedures indicated in Section 5.0 of the determinative method of interest. Calibrate the chromatographic system using either the external standard technique or the internal standard technique as contained in Section 7.0 of USEPA method 8000A.

Prior to calibration, the instrument(s) used for Gas Chromatograph/Mass Spectrometer (GC/MS) analyses are tuned by analysis of p-bromofluorobenzene (BFB) for volatile analyses and decafluorotriphenyl phosphine (DFTPP) for semi-volatile analyses. Once the tuning criteria specified in the method for these reference compounds are met, the instrument should be initially calibrated by using a five point calibration curve. The instrument tune will be verified each 12 hours of operation.

### 5.3.2 Continuing Calibration for Organic Analyses

#### 5.3.2.1 Gas Chromatography

The working calibration curve or calibration factor must be initially verified at the beginning of each working day by the injection of one or more calibration standards. The acceptable response criteria for any analyte of interest is  $\pm 15\%$  of the response from the original calibration. If the response for any analyte of interest does not meet the acceptable response criteria no analyses for that analyte can occur until corrective action is taken and a new calibration curve prepared for that analyte.

For each analytical run, after the initial verification, continuing calibration verification of the working calibration curve or calibration factor must be performed every 12 hours and at the end of the run. The acceptable response criteria for any analyte of interest varies is  $\pm 15\%$  of the original response. If the response for any analyte of interest does not meet the acceptable response criteria, the run is terminated, corrective action taken, a new calibration curve be prepared for that analyte and any samples analyzed since the last acceptable calibration verification must be reanalyzed.

#### 5.3.2.2 Gas Chromatograph / Mass Spectrometry

The working calibration curve, calibration factor or response factor must be initially verified at the beginning of each analytical run day and every 12 hours during analysis by the techniques specified in section 7.4 of the SW-846 GC/MS methods. The acceptable response criteria for any analyte of interest are provided in section 7.4 of the SW-846 GC/MS methods.

### 5.3.3 Calibration for Metallic Analytes by Spectrometer

Establish spectrometer operating parameters equivalent to those indicated in Section 7.0 of the USEPA SW-846 determinative method of interest. Prepare calibration standards using the procedures indicated in Section 5.0 of the determinative method of interest. Calibrate the

TABLE 5-2  
 RECOMMENDED CLEANUP TECHNIQUES FOR INDICATED GROUPS OF COMPOUNDS

Analyte Group	Determinative Method *	Cleanup Method Option
Phenols	8040	3630 <sup>b</sup> , 3640, 3650, 8040 <sup>c</sup>
Phthalate esters	8060	3610, 3620, 3640
Nitrosamines	8070	3610, 3620, 3640
Organochlorine pesticides & PCB's	8080	3620, 3640, 3660
Nitroaromatics and cyclic ketones	8090	3620, 3640
Polynuclear aromatic hydrocarbons	8100	3611, 3630, 3640
Chlorinated hydrocarbons	8120	3620, 3640
Organophosphorus pesticides	8140	3620
Chlorinated herbicides	8150	8150 <sup>d</sup>
Priority pollutant semivolatiles	8250, 8270	3640, 3650, 3660
Petroleum waste	8250, 8270	3611, 3650

- \* The GC/MS Methods, 8250 and 8270, are also appropriate determinative methods for all analyte groups, unless lower detection limits are required.
- <sup>b</sup> Cleanup applicable to derivatized phenols.
- <sup>c</sup> Method 8040 includes a derivatization technique followed by GC/ECD analysis, if interferences are encountered using GC/FID.
- <sup>d</sup> Method 8150 incorporates an acid-base cleanup step as an integral part of the method.

## 6.0 DATA REDUCTION, VALIDATION, AND REPORTING

In the Site Remediation Program (Program) the laboratory generated analytical data must be checked for precision, accuracy, and completeness. The Program participant and the analytical laboratory have the responsibility of assuring that the analytical data submitted to the Agency meets the Program's precision, accuracy, and completeness objectives. In addition the Agency's Project Managers will, at their discretion, have the Division of Laboratories, Quality Assurance Section review data for compliance with the QA requirements contained in this document. In order to facilitate the Agency's review and acceptance of laboratory analytical data, it is the responsibility of the participant to report laboratory data to the Agency in the standard format (specified in Appendix A) using Agency defined criteria for data reduction, validation and reporting. This section of the Program's Analytical Quality Assurance Plan details the requirements for reduction, validation and reporting of laboratory data.

### 6.1 LABORATORY DATA REDUCTION

The laboratory data reduction from raw data to finished result is to be performed according to the directions contained in Section 7.0 of the applicable USEPA SW-846 methods used for sample analysis. Aqueous sample results are to be reported in micrograms per Liter ( $\mu\text{g/L}$ ). Solid sample results are to be reported in micrograms per Kilogram ( $\mu\text{g/Kg}$ ) on a dry weight basis. The reported results must not be corrected for any blank results (i.e. no reporting blank subtracted data). **Appendix A to this AQAP contains the forms and procedures that must be used for reporting Program laboratory data to the Agency.**

### 6.2 LABORATORY DATA VALIDATION

#### 6.2.1 Routine Laboratory Data Validation

The laboratory will perform in-house analytical data validation under the direction of the laboratory QA Officer or laboratory Director. The laboratory QA Officer or laboratory Director is responsible for assessing data quality and advising of any data which were rated "preliminary", "estimated", or "unacceptable" or other notations which would caution the data user of possible unreliability. Data validation by the laboratory should be conducted as follows:

- o Raw data produced by the analyst is turned over to the respective area supervisor.
- o The area supervisor reviews the data for attainment of quality control criteria as outlined in Sections 2.0 and 7.0 of this document and for overall reasonableness.
- o Upon acceptance of the raw data by the area supervisor, a report is generated and sent to the laboratory QA Officer or laboratory Director.

- o The laboratory QA Officer or laboratory Director will complete a thorough audit of reports.
- o The QA Officer or laboratory Director and area supervisors will decide whether any sample reanalysis is required.
- o Upon acceptance of the preliminary reports by the QA Officer, final reports will be generated and signed by the Laboratory Project Manager. The laboratory package shall be presented in the same order in which the samples were analyzed. **The laboratory package must contain all the required forms as specified in Appendix A and the appropriate data flags as defined below.**

The laboratory will prepare and retain full analytical and QC documentation. Including but not limited to, raw data system printouts (or legible photocopies) identifying date of analyses, analyst, parameters determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes and control samples. As needed, the laboratory shall supply a hard copy of the retained information.

#### 6.2.2 Non-Routine Laboratory Data Validation

Data submitted to the Agency in support of a request for a change or modification of the Agency's Program quality assurance objectives (see Section 2.5) must undergo additional validation by the laboratory. The additional validation consists of indicating the likely bias as compared to the Program quality assurance objectives. The additional non-routine data qualification flags and the criteria for their use are listed in Tables 6-1, 6-2, and 6-3. The data reporting forms must be completed as instructed in Appendix A and then the data qualification flags from Table 6-1 added to the forms. The data reported in support of the request must have sufficient supporting documentation to allow the Agency's Division of Laboratories, Quality Assurance Section (QAS) to review the request and advise the Agency's Project Manager of the validity of the request for change or modification of the Agency's Program quality assurance objectives.

#### 6.2.3 Agency Data Validation

The Agency's Project Manager may at their discretion request the QAS to review any and/or all data submitted to the Agency for a Program site. The QAS will review and validate the data for compliance with this Analytical Quality Assurance Program and for suitability as Level IIIA or IIIB data. The QAS will issue a validation findings report to the Agency's Project Manager. The Agency's Project Manager will inform the Program participant of any required corrective actions, if any.

### 6.3 LABORATORY DATA REPORTING

The laboratory will report the data in the same chronological order in which it analyses along with QC data. The laboratory will provide the following information to the Program participant in each analytical data package submitted:

1. Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.
2. Tabulated results of inorganic and organic compounds identified and quantified, including the data flags (see sections 6.2.1 and 6.2.2 above).
  - A. The routine laboratory-provided data flags for organic analyses will include :
    - U - The analyte was analyzed for but not detected (i.e. less than detection/reporting limit). The sample quantitation limit must be corrected for dilution and for percent moisture.
    - J - Indicates an estimated concentration. Use when estimating a concentration of a tentatively identified compound, or if reporting a result that is less than the required quantitation limit. Also to be used when reporting data which does not meet quality control performance criteria during analyses (e.g. spike recovery outside of control limits).
    - B - This flag is used when the analyte is found in the associated blank as well as in the sample. It indicates possible / probable blank contamination and warns the data user to take appropriate action.

Appendix A of this Analytical Quality Assurance Plan contains the forms to be used by the laboratory to report data for the Program. The above described flags must be used. The laboratory may choose to use additional data flags for organic analyses, however, the laboratory must provide detailed definitions of the additional flags used.

- B. The routine laboratory-provided data flags for inorganic analyses will include :
  - U - The analyte was analyzed for but not detected (i.e. less than detection/reporting limit). The sample quantitation limit must be corrected for dilution and for percent moisture.
  - J - Indicates an estimated concentration. Use when reporting data which does not meet quality control performance criteria during analyses (e.g. spike recovery outside of control limits).

- B - This flag is used when the analyte is found and the laboratory reported result is less than the required quantitation limit.

Appendix A of this Analytical Quality Assurance Plan contains the forms to be used by the laboratory to report data for the Program. The above described flags must be used. The laboratory may choose to use additional data flags for inorganic analyses, however, the laboratory must provide detailed definitions of the additional flags used.

- C. The non-routine laboratory data flags for organic and inorganic analyses are detailed in Tables 6-1 through 6-3.

3. Analytical results for QC sample spikes, sample duplicates, initial and a continuous calibration verifications of standards and blanks, standard procedural blanks, laboratory control samples and ICP interference check samples. For organic analyses, the data packages must include matrix spikes, matrix spike duplicates, and surrogate spike recoveries. The data package will be reported to the Agency for assessment. Appendix A of this Analytical Quality Assurance Plan contains the forms to be used by the laboratory to report data for the Program.
4. Tabulation of instrument detection limits determined in pure water.

Appendix A of this Analytical Quality Assurance Plan contains the forms to be used by the laboratory to report data for the Program. Appendix A also contains instructions for filling out and completing the forms (exclusive of data flagging which must be accomplished per this section of the Analytical Quality Assurance Program). The use of commercial form generating software is acceptable as long as the required flags are provided when data is reported. Reporting data with flags written by hand upon software generated forms is acceptable.

Table 6-1  
 Non - Routine Data Flags  
 Organic Analyses by GC/MS

Parameter & Criteria	Actions	Data Flag
Holding times, exceeded	All associated samples	L
Mass Calibration Ion Abundance, not met	All associated data	P
Calibrations		
- initial, Ave RRF <0.05	Analyte Specific, positive results	L
- initial, %RSD >30%	Analyte Specific, positive results	P
- continuing, Ave RRF <0.05	Analyte Specific, positive results	L
- continuing, %D >25%	Analyte Specific, positive results	P
Blanks, results between DL and RQL	Analyte Specific	H
Surrogates,		
- If %R low but >25%	Fraction Specific	L
- If %R <25%	Fraction Specific	R
- If %R High	Fraction Specific	H
Internal Standards, IS area count outside -50% or +100% of associated standard	Associated analytes	P
Laboratory Control Samples, Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >50%	Associated samples	L
- % Recovery <50%	Associated samples	R
Duplicates, Differences		
- % Differences High	Associated samples	P
Matrix Spikes, Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >40%	Associated samples	L
- % Recovery <40%	Associated samples	R

**Data Flags**

- L = Low: The associated result may underestimate the true value
- H = High: The associated result may overestimate the true value
- P = Precision: The associated result may be of poor precision (high variability)
- R = Rejected: The associated result should be rejected for making critical decisions and determinations

Table 6-2  
 Non-Routine Data Flags  
 Organic Analyses by GC or HPLC

Parameter & Criteria	Actions	Data Flags
Holding times, exceeded	All associated samples	L
Instrument Performance Checks		
- Required % Recoveries not met	All associated data	L or H
- Required RPD or %Difference not met	All associated data	P
Calibrations		
- initial, linearity criteria not met	Associated positive data	P
- continuing, % Difference between calibration factors criteria not met	Associated positive data	P
Surrogates		
- If %R low but >25%	Fraction specific	L
- If %R <25%	Fraction specific	R
- If %R High	Fraction specific	H
Laboratory Control Samples, Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >50%	Associated samples	L
- % Recovery <50%	Associated samples	R
Duplicates, Differences		
- % Differences High	Associated samples	P
Matrix Spikes, Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >40%	Associated samples	L
- % Recovery <40%	Associated samples	R

Data Flags

- L = Low: The associated result may underestimate the true value
- H = High: The associated result may overestimate the true value
- P = Precision: The associated result may be of poor precision (high variability)
- R = Rejected: The associated result should be rejected for making critical decisions and determinations

Table 6-3  
 Non-Routine Data Flags  
 Inorganic Analyses

Parameter & Criteria	Actions	Data Flag
Holding times, exceeded	All associated samples	L
Calibrations.		
- initial, correlation coefficient unacceptable	Associated samples	P
- continuing criteria not met, %R high	Associated samples	H
- continuing criteria not met, %R low	Associated samples	L
ICS (for ICP), Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >50%	Associated samples	L
- % Recovery <50%	Associated samples	R
Laboratory Control Samples, Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >50%	Associated samples	L
- % Recovery <50%	Associated samples	R
Duplicates, Differences		
- % Differences High	Associated samples	P
Matrix Spikes, Recoveries		
- % Recovery High	Associated samples	H
- % Recovery Low, but >40%	Associated samples	L
- % Recovery <40%	Associated samples	R

**Data Flags**

- L = Low: The associated result may underestimate the true value
- H = High: The associated result may overestimate the true value
- P = Precision: The associated result may be of poor precision (high variability)
- R = Rejected: The associated result should be rejected for making critical decisions and determinations

## 7.0 INTERNAL QUALITY CONTROL CHECKS

To ensure the production of analytical data of known and documented quality there are two types of quality assurance that should be used by the laboratory conducting analyses for Site Remediation Program (Program) projects. The two types are program quality assurance and analytical quality control.

The laboratory should have a written Quality Assurance/Quality Control (QA/QC) program which provides rules and guidelines to ensure the reliability and validity of work conducted at the laboratory. Compliance with the QA/QC program should be coordinated and monitored by a laboratory Quality Assurance Officer, which is independent of the operating departments.

This section of the Program's Analytical Quality Assurance Plan addresses the specific QC checks to apply to laboratory analytical activities in order to meet the Program's QA objectives (see Section 2.0 of this document).

### 7.1 DEFINITIONS OF QUALITY CONTROL CHECKS USED IN SITE REMEDIATION PROGRAM

#### 7.1.1 Laboratory Duplicates

Samples are analyzed in duplicate at the specified frequency in order to evaluate laboratory precision for a particular sample matrix. Duplicate samples are prepared by processing two distinct sample aliquots, from a single environmental sample, through the entire analytical process, beginning with sample extraction/digestion all the way to sample reporting. **Duplicates are not to be confused with replicates, replicates refer to repetitive analyses of a single sample extract/digest.**

#### 7.1.2 Laboratory Matrix Spikes

Matrix Spike samples are used to assess the ability of the laboratory to recover target analytes from a particular sample matrix. In the absence of severe matrix interferences, the analysis of matrix spikes provide information on method accuracy. Matrix Spikes are prepared by adding a known concentration of one or more target analytes to an aliquot of environmental sample, and then processing the samples through each step of the preparation and analysis systems.

#### 7.1.3 Laboratory Spiked Blanks

Laboratory Spiked Blanks are used to provide a measure of the analytical performance in the absence of any matrix related interferences. The samples are prepared by adding known concentrations of target analytes to an aliquot of laboratory reagent water, and then processing the sample through each step of the preparation and analysis systems.

#### 7.1.4 Surrogate Spikes

Surrogates are associated with sample analyses for organic constituents. Surrogate compounds

can be either, environmentally "rare" analytes similar to actual method analytes or method analytes that are not target analytes for the project. For GC/MS analyses, surrogates are typically deuterated analogs of actual target analytes. Surrogates are added to all samples (including other QC samples) for GC, GC/MS, HPLC, or HPLC/MS analysis prior to any preparation (extraction, purge) step. The recovery of surrogates provides an indication of target analyte recovery from a particular matrix by a particular analytical technique.

#### 7.1.5 Method Blanks

Method Blanks provide an indication of laboratory internal contamination. Method Blanks consist of an aliquot of laboratory reagent water processed through all steps of the analytical preparation and analysis system. If field blanks and Method Blanks show similar types and concentrations of contaminants, the source of the contamination is most likely the laboratory.

#### 7.1.6 Standard Reference Materials

Standard Reference Materials (SRMs) are materials of known composition and concentration that are obtained from a commercial vendor. Many SRMs are traceable to either the U.S.EPA or the National Institute of Standards and Technology (formerly NBS). SRMs are used for verification of calibration standards and associated calibrations and general troubleshooting.

#### 7.1.7 Independent Check Standards

Independent Checks Standards are standards prepared by the laboratory from a source different than the source from which the calibration standards are prepared (i.e. second source standard). Independent Check Standards are used for verification of calibration standards and associated calibrations and general troubleshooting.

### 7.2 ORGANIC QUALITY CONTROL CHECK ANALYSES

Organic analyses for Program projects require the use Laboratory Duplicates, Matrix Spikes, Spike Blanks, Surrogates, and Method Blanks.

#### 7.2.1 Spiking Requirements

##### 7.2.1.1 Matrix Spikes / Matrix Spike Duplicates

The requirement for Laboratory Duplicates and Matrix Spikes will be accomplished by the analysis of Matrix Spike/Matrix Spike Duplicates. These are matrix spikes prepared in duplicate, from the same environmental sample. For Level IIIA the analysis of Matrix Spike /Matrix Spike Duplicates will be at a frequency of one per 20 or fewer samples. For Level IIIB the analysis of Matrix Spike / Matrix Spike Duplicates will be at a frequency of one per ten or fewer samples per matrix.

The requirement for Matrix Spike / Matrix Spike Duplicates will be accomplished by utilizing

the Matrix Spike compounds recommended by the chosen analytical method. For those analytical methods which don't recommend Matrix Spike compounds, the laboratory must select compound(s) from the method analyte list. The number of Matrix Spike compounds spiked into the Matrix Spike / Matrix Spike Duplicate samples must be at a minimum of 10% of the number of target analytes (i.e. a Matrix Spike sample analyzed for one to ten target analytes by one analytical method must have a minimum of one Matrix Spike compound spiked into the sample, a sample analyzed for 11 to 20 target analytes by one analytical method must have a minimum of two Matrix Spike compounds spiked into the sample, etc.)

#### 7.2.1.2 Surrogate Compounds

The requirement for Surrogates will be accomplished by utilizing the surrogate compounds recommended by the chosen analytical method. For those analytical methods which don't recommend surrogates, the laboratory must select compound(s) from the method analyte list which are not expected to be present in the environmental samples. The number of surrogate compounds spiked into each sample must be at a minimum of 10% of the number of target analytes (i.e. a sample analyzed for one to ten target analytes by one analytical method must have a minimum of one surrogate spiked into the sample, a sample analyzed for 11 to 20 target analytes by one analytical method must have a minimum two surrogate spiked into the sample, etc.)

#### 7.2.2 Spiking Quantities

For Matrix Spike/Matrix Spike Duplicates, Spike Blanks, and Surrogates the quantity of the compounds spiked into the sample must result in a final concentration in the sample of 3 to 10 times the Required Quantitation Limits for Level IIIA analyses and 3 to 10 times the Estimated Quantitation Limits for Level IIIB analyses (see Tables 1-1 through 1-4 for Required Quantitation Limits for Level IIIA analyses and Table 1-5 for Estimated Quantitation Limits for Level IIIB analyses).

#### 7.2.3 Organic OC Limits

The QC limits for Matrix Spike/Matrix Spike Duplicates, Spike Blanks, and Surrogates are contained in Tables 2-2 through 2-56. The spike recovery limits for Matrix Spikes, Spike Blanks and Surrogates are contained in the Accuracy column. The difference limits for the Matrix Spike/Matrix Spike Duplicates are contained in the Precision column.

For all blanks the QC limits are for the blank concentration to be less than the analytical methods Required Detection Limits.

### 7.3 INORGANIC QUALITY CONTROL CHECK ANALYSES

Inorganic analyses for Program projects require the use of Laboratory Duplicates, Matrix Spikes, Spike Blanks, Standard Reference Materials (SRMs) and Independent Checks Standards.

### 7.3.1 Spiking Requirements

The requirement for Matrix Spikes and Spiked Blanks for Level IIIA will be at a frequency of one per 20 or fewer samples. For Level IIIB the Matrix Spike and Spiked Blanks will be at a frequency of one per ten or fewer samples per matrix.

### 7.3.2 Spiking Quantities

For Matrix Spike and Spike Blanks the quantity of the analytes spiked into the sample must result in a final concentration in the sample of 3 to 10 times the Required Quantitation Limits for Level IIIA analyses and 3 to 10 times the Estimated Quantitation Limits for Level IIIB analyses (see Tables 1-1 through 1-4 for Required Quantitation Limits for Level IIIA analyses and Table 1-5 for Estimated Quantitation Limits for Level IIIB analyses).

### 7.3.3 Inorganic QC Limits

The QC limits for Laboratory Duplicates, Matrix Spikes, Spike Blanks, Standard Reference Materials (SRMs) and Independent Checks Standards are contained in Tables 2-2, 2-57 and 2-58. The spike recovery limits for Matrix Spikes, and Spike Blanks are contained in the Accuracy column. The difference limits for the Laboratory Duplicates are contained in the Precision column. The QC limits for Standard Reference Materials (SRMs) and Independent Checks Standards is dependant upon the use of the Standard Reference Materials (SRMs) and Independent Checks Standards. Whenever the Standard Reference Materials (SRMs) and Independent Checks Standards are to be used for overall analytical precision the QC limits are contained in the Accuracy column of Tables 2-2, 2-57 and 2-58. Whenever the Standard Reference Materials (SRMs) and Independent Checks Standards are to be used to demonstrate or verify an acceptable calibration the QC limits are contained in section 5.0.

For all blanks the QC limits are for the concentration to be less than the analytical methods' Quantitation Limits.

## 8.0 PERFORMANCE AND SYSTEMS AUDITS

Performance and system audits are conducted as a systematic check to determine the quality of operation and to monitor the capability and performance of the laboratory analytical systems. A performance audit independently collects measurement data using performance evaluation samples. Performance audits are quantitative in nature. A system audit consists of a review of the total data production process. A system audit includes on-site review of the laboratory's operational systems and physical facilities. System audits are qualitative in nature.

### 8.1 INTERNAL AUDITS

The internal performance and system audits of the laboratory should be conducted by the laboratory QA Officer and/or laboratory Director.

#### 8.1.1 Internal Performance Audits

For Site Remediation Program (Program) projects the laboratory QA Officer and/or laboratory Director should submit blind QC samples along with project samples to the laboratory for analysis. The QA Officer should evaluate the analytical results of these blind performance samples to ensure the laboratory maintain a good performance.

#### 8.1.2 Internal Systems Audits

For Program projects the laboratory QA Officer and/or laboratory Director should perform system audits, which will include examination laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedure, sample preparation and analysis, instrument operating records, etc.

### 8.2 EXTERNAL AUDITS

#### 8.2.1 External Performance Audits

For Program projects the laboratory is encouraged to participate in external performance audits. The performance audits should consist of the analysis of independent or commercial check samples and participation in the USEPA's performance evaluation sample surveys for ongoing assessment of laboratory precision and accuracy. The analytical results of the analysis of performance evaluation samples are to ensure the laboratory maintain a good performance. The performance audits should be conducted on a quarterly basis. All information generated from performance evaluation sample programs should be made available during systems audits or

upon request.

### 8.2.2 External Systems Audits

For Program projects an external systems audit is an on-site inspection and review of a laboratory's quality control system by the Agency Project Manager or their designate (Division Of Laboratories/ Quality Assurance Section (QAS) personnel). At the Agency Project Manager's discretion the system audits, will include examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain of custody procedures, sample preparation and analysis, records control, instrument operating records, etc. The systems audit will determine whether the laboratory is adhering to this Analytical Quality Assurance Program and what level(s) of data the laboratory is capable of generating.. The QAS will issue an audit findings report to the Agency Project Manager. The external systems audits and findings report apply only to the Site Remediation Program, they do not constitute a formal certification or endorsement by the Illinois EPA nor are they applicable to other Agency Programs.

## 9.0 CALCULATIONS OF DATA QUALITY INDICATORS

A laboratory generating data for Site Remediation Program (Program) projects must assess their laboratory results for compliance with required precision, accuracy, completeness and sensitivity as follows:

### 9.1 PRECISION

Precision of laboratory analysis will be assessed by comparing the analytical results between matrix spike/matrix spike duplicate (MS/MSD) for organic analysis, and laboratory duplicate analyses for inorganic analysis. The relative percent difference (%RPD) will be calculated for each pair of duplicate analysis using the Equation 9-1.

$$\%RPD = \frac{S - D}{(S + D)/2} \times 100 \quad \text{Equ. 9-1}$$

Where: S = First sample value (original or MS value)

D = Second sample value (duplicate or MSD value)

### 9.2 ACCURACY

Accuracy of laboratory results will be assessed for compliance with the established QC criteria that are described in Section 2.0 of this Analytical Quality Assurance Program using the analytical results of method blanks, reagent/preparation blank, matrix spike/matrix spike duplicate samples, field blank, and bottle blanks. The percent recovery (%R) of matrix spike samples will be calculated using Equation 9-2.

$$\%R = \frac{A - B}{C} \times 100 \quad \text{Equ. 9-2}$$

Where:

A = The analyte concentration determined experimentally from the spiked sample;

B = The background level determined by a separate analysis of the unspiked sample and;

C = The amount of the spike added.

### 9.3    COMPLETENESS

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 9-3.

$$\text{Completeness} = \frac{\text{valid analyses reported}}{\text{total analyses requested}} \times 100 \quad \text{Equ. 9-3}$$

### 9.4    SENSITIVITY

The achievement of method detection limits depend on instrumental sensitivity and matrix effects. Therefore it is important to monitor the instrumental sensitivity to ensure the data quality through constant instrument performance. The laboratory should monitor instrumental sensitivity through the analysis of method blank, calibration check sample, and laboratory control samples, etc.

## 10.0 CORRECTIVE ACTIONS

For Site Remediation Program (Program) projects the laboratory should have a written SOP specifying that corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The corrective action taken is somewhat dependent on the analysis and the event. The SOP should document the corrective action and notification by the analyst about the errors and corrective procedures.

Laboratory personnel are alerted that corrective actions may be necessary if:

- o QC data are outside the warning or acceptable windows for precision and accuracy;
- o Blanks contain target analytes above acceptable levels;
- o Undesirable trends are detected in spike recoveries or RPD between duplicates;
- o There are unusual changes in detection limits;
- o Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples; or
- o Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, and so on. If the problem persists or cannot be identified, the matter is referred to the laboratory supervisor, manager and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

For data submitted to the Agency which does not meet the Quality Assurance Objectives for the Program, corrective action may include:

- Re-analyzing the samples, if holding time criteria permits;
- Resampling and analyzing, and/or,
- Evaluating and amending analytical procedures; and/or,
- Accepting data and acknowledging the level of uncertainty.

## INORGANIC REPORTING FORM INSTRUCTIONS

**FORM I - INORGANIC ANALYSIS DATA SHEET:** This form is used to tabulate and report sample analysis results for target analytes.

Complete the header information.

"Date Received" is the date (formatted MM/DD/YY) of sample receipt at the laboratory.

"% Solids" is the percent of solids on a weight/weight basis in the sample as determined by drying the sample. Report percent solids to one decimal place. If the percent solids is not required because the sample is fully aqueous or less than 1% solids, then enter "0.0".

Enter the appropriate concentration units ( $\mu\text{g/L}$  for water or mg/Kg dry weight for soil).

Under the column labeled "Concentration", enter for each analyte either the value of the result or the Acceptable Quantitation Limit for the analyte corrected for any dilutions and/or percent moisture in soil samples.

FORM I-IN includes fields for three types of result flags. These flags must be completed as follows:

C (Concentration) flag: Enter the flag as specified in section 6.3 of the Analytical Quality Assurance Plan (AQAP)

Q (Qualification) flag: Enter the flag as specified in section 6.3 of the Analytical Quality Assurance Plan (AQAP).

M (Method) flag: Enter the USEPA analytical Method Number used to obtain the results for the reported analytes:

**FORM II-INORGANIC INITIAL AND CONTINUING CALIBRATION VERIFICATION:**  
This form is used to report analyte recoveries from calibration solutions.

Complete the header information.

Under "Initial Calibration True", enter the value (in  $\mu\text{g/L}$ , to one decimal place) of the concentration of each analyte in the Initial Calibration Verification Solution.

Under "Initial Calibration Found", enter the most recent value (in  $\mu\text{g/l}$ , to one decimal place), of the concentration of each analyte measured in the Initial Calibration Verification Solution.

Under "Initial Calibration %R", enter the value (to one decimal place) of the percent recovery computed according to the following equation:

$$\%R = \frac{\text{Found (ICV)}}{\text{True (ICV)}} \times 100$$

where; True (ICV) is the true concentration of the analyte in the Initial Calibration Verification Solution and Found (ICV) is the found concentration of the analyte in the Initial Calibration Verification Solution.

Under "Continuing Calibration True", enter the value (in  $\mu\text{g/L}$ , to one decimal place) of the concentration of each analyte in the Continuing Calibration Verification Solution.

Under "Continuing Calibration Found", enter the value (in  $\mu\text{g/L}$ , to one decimal place) of the concentration of each analyte measured in the Continuing Calibration Verification Solution.

Note that the form contains two "Continuing Calibration Found" columns. The column to the left must contain values for the first Continuing Calibration Verification, and the column to the right must contain values for the second Continuing Calibration Verification. The column to the right should be left blank if no second Continuing Calibration Verification was performed.

Under "Continuing Calibration %R", enter the value (to one decimal place) of the percent recovery computed according to the following equation:

$$\%R = \frac{\text{Found (CCV)}}{\text{True (CCV)}} \times 100$$

where; True (CCV) is the true concentration of each analyte, and Found (CCV) is the found concentration of the analyte in the Continuing Calibration Verification Solution.

Note that the form contains two "Continuing Calibration %R" columns. Entries to these columns must follow the sequence detailed above for entries to the "Continuing Calibration Found" columns.

Under "M", enter the USEPA number of the appropriate method used to obtain the results

The order of reporting ICV's and CCV's for each analyte must follow the temporal order in which the standards were run starting with the first Form II and moving from the left to the right continuing to the subsequent Form IIs as appropriate.

**FORM III-INORGANIC BLANKS:** This form is used to report analyte concentrations found in the Initial Calibration Blank (ICB), in Continuing Calibration Blanks (CCB), and in the Preparation Blank (PB).

Complete the header information.

According to the matrix specified for the Preparation Blank, circle " $\mu\text{g/L}$ " (for water) or " $\text{mg/Kg}$ " (for soil) as the Preparation Blank concentration units. If results for more than one matrix are being reported in the data package, then the Preparation Blank results for each matrix must be reported on separate Form IIIs.

Under "Initial Calibration Blank", enter the concentration (in  $\mu\text{g/L}$ , to one decimal place) of each analyte in the most recent Initial Calibration Blank.

Under the "C" flag field, for any analyte enter "U" or "B" as appropriate and defined in section 6.3 of the AQAP.

Under "Continuing Calibration Blank 1", enter the concentration (in  $\mu\text{g/L}$ , to one decimal place) of each analyte detected in the first required Continuing Calibration Blank (CCB) analyzed after the Initial Calibration Blank. Enter any appropriate flag, as explained for the "Initial Calibration Blank", to the "C" flag column immediately following the "Continuing Calibration Blank 1" column.

If only one Continuing Calibration Blank was analyzed, then leave the columns labeled "2" and "3" blank. If up to three CCB's were analyzed, complete the columns labeled "2" and "3", in accordance with the instructions for the "Continuing Calibration Blank 1" column. If more than three Continuing Calibration Blanks were analyzed, then complete additional FORMs III-IN as appropriate.

Under "Preparation Blank", enter the concentration in  $\mu\text{g/L}$  (to one decimal places) for a water blank or in  $\text{mg/kg}$  (to two decimal places) for a soil blank, of each analyte in the Preparation Blank. Enter any appropriate flag, as explained for the "Initial Calibration Blank", to the "C" flag column immediately following the "Preparation Blank" column.

For all blanks, enter the concentration of each analyte (positive or negative) measured above the Acceptable Quantitation Limit (AQL) or below the negative value of the AQL.

Under "M", enter the USEPA number of the appropriate method used to obtain the results

The order of reporting ICB's and CCB's for each analyte must follow the temporal order in which the blanks were run starting with the first Form III and moving from left to right and continuing to the following Form III's.

**FORM IV-INORGANIC ICP INTERFERENCE CHECK SAMPLE:** This form is used to report Interference Check Sample (ICS) results for each ICP instrument.

Complete the header information..

Under "True Sol. A", enter the true concentration of each analyte present in Solution A.

Under "True Sol. AB", enter the true concentration of each analyte present in Solution AB.

Under "Initial Found Sol. A", enter the concentration of each analyte found in the initial analysis of Solution A.

Under "Initial Found Sol. AB", enter the concentration of each analyte in the initial analysis of Solution AB.

Under "Initial Found %R", enter the value of the percent recovery computed for true solution AB greater than zero according to the following equation:

$$\% R = \frac{\text{Initial Found Sol. AB}}{\text{True Sol. AB}} \times 100$$

Under "Final Found Sol.A", enter the concentration of each analyte found in the final analysis of Solution A.

Under "Final Found Sol. AB", enter the concentration of each analyte found in the final analysis of Solution AB.

Under "Final Found %R", enter the value of the percent recovery computed according to the following equation:

$$\% R = \frac{\text{Final Found Sol. AB}}{\text{True Sol. AB}} \times 100$$

If more ICS analyses were required, submit additional FORM IVs as appropriate.

The order of reporting ICSs for each analyte must follow the temporal order in which the standards were run starting with the first Form IV and continuing to the following Form IV's as appropriate.

**FORM V INORGANIC SPIKE SAMPLE RECOVERY:** This form is used to report results for the pre-digest spike.

Complete the header information.

Under "Control Limit %R", enter the QC limits as specified in section 7.3 of the AQAP.

Under "Spiked Sample Result (SSR)", enter the measured value, in appropriate units, for each relevant analyte in the matrix spike sample. Enter any appropriate flag, to the "C" flag column immediately following the "Spiked Sample Result (SSR)" column.

Under "Sample Result (SR)", enter the measured value for each required analyte in the sample on which the matrix spike was performed. Enter any appropriate flag, to the "C" flag column immediately following the "Sample Result (SR)" column.

Under "Spike Added (SA)", enter the value for the concentration of each analyte added to the sample. The same concentration units must be used for spiked sample results, unspiked (original sample) results, and spike added sample results.

Under "%R", enter the value of the percent recovery for all spiked analytes computed according to the following equation:

$$\%R = \frac{(SSR - SR)}{SA} \times 100$$

%R must be reported, whether it is negative, positive or zero.

Under "Q", enter "J" if the Spike Recovery (%R) is out of the control limits.

If different samples were used for spike sample analysis of different analytes, additional FORM Vs must be submitted for each sample as appropriate.

**FORM VI INORGANIC DUPLICATES:** The duplicates form is used to report results of duplicate analyses. Duplicate analyses are required for % solids values and all analyte results.

Complete the header information..

For "% Solids for Sample", enter to percent solids for the original sample of the Sample Number reported on the form.

Under "Control Limit", enter the QC limits as specified in section 7.3 of the AQAP. If the sample and duplicate values were less than the AQL leave the field empty.

Under Sample (S), enter the original measured value for the concentration of each analyte in the sample on which a Duplicate analysis was performed. Concentration units are those specified on the form. Enter any appropriate flag, to the "C" flag column immediately following the "Sample (S)" column.

Under Duplicate (D), enter the measured value for each analyte in the Duplicate sample. Concentration units are those specified on the form. Enter any appropriate flag, to the "C" flag column immediately following the "Duplicate (D)" column.

Under RPD, enter the absolute value of the RPD for all analytes detected above the AQL in either the sample or the duplicate, computed according to the following equation:

$$RPD = \frac{|S-D|}{\left[ \frac{S+D}{2} \right]} \times 100$$

The values for S and D must be exactly those reported on this form. A value of zero must be substituted for S or D if the analyte concentration is less than the reporting limit in either one. If the analyte concentration is less than the reporting limit in both S and D, leave the RPD field empty.

**FORM VII - INORGANIC LABORATORY CONTROL SAMPLE:** This form is used to report results for the solid and aqueous Laboratory Control Samples.

Complete the header information..

Under "Aqueous True", enter the value of the concentration of each analyte in the Aqueous LCS Standard Source.

Under "Aqueous Found", enter the measured concentration of each analyte found in the Aqueous

LCS solution.

Under "Aqueous %R", enter the value of the percent recovery computed according to the following equation:

$$\% R = \frac{\text{Aqueous LCS Found}}{\text{Aqueous LCS True}} \times 100$$

Under "Solid True", enter the value of the concentration of each analyte in the Solid LCS Source.

Under "Solid Found", enter the measured value of each analyte found in the Solid LCS solution.

Under "C", enter "B" or "U" as specified in the AQAP or leave empty, to describe the found value of the solid LCS.

Under "Limits", enter the QC limits as specified in section 7.3 of the AQAP.

Under "Solid %R", enter the value of the percent recovery computed according to the following equation:

$$\% R = \frac{\text{Solid LCS Found}}{\text{Solid LCS True}} \times 100$$

If the analyte concentration is less than the quantitation limit, a value of zero must be substituted for the solid LCS found.

Submit additional FORM VIIs as appropriate, if more than one aqueous LCS or solid LCS was required.

**FORM VIII-INORGANIC ICP SERIAL DILUTION:** This form is used to report results for serial dilution. The serial dilution should be used in accordance with Section 8 of USEPA SW-846 Method 7000A and Section 8 of USEPA SW-846 Method 6010A.

Complete the header information.

Under "Initial Sample Result (I)", enter the measured value for each analyte in the undiluted sample. Enter any appropriate flag to the "C" flag column immediately following the "Initial Sample Result (I)" column.

Under "Serial Dilution Result (S)", enter the measured concentration value for each analyte in the

diluted sample. The value must be adjusted for that dilution. Enter any appropriate flag, to the "C" flag column immediately following the "Serial Dilution Result (S)" column.

Note that the Serial Dilution Result (S) is obtained by multiplying by the dilution factor the instrument measured value of the serially diluted sample and that the "C" flag for the serial dilution must be established based on the instrument measured value before correcting it for the dilution regardless of the value reported on the form.

Under "% Difference", enter the absolute value of the percent difference in concentration of required analytes, between the original sample and the diluted sample according to the following formula:

$$\% \text{ Difference} = \frac{|I - S|}{I} \times 100$$

A value of zero must be substituted for S if the analyte concentration is less than the AQL or Instrument Detection Limit. If the analyte concentration in (I) is less than the AQL or IDL concentration, leave the "% Difference" field empty.

Under "Q", enter "J" if the % Difference is greater than 10% and the original sample concentration is greater than 50x the reporting limit or IDL, whichever is lower.

**FORM IX - INORGANIC STANDARD ADDITION RESULTS:** This form is used to report the results of samples analyzed using the Method of Standard Additions (MSA) for Furnace AA analysis. The MSA should be used in accordance with Section 8 of USEPA SW-846 Method 7000A and Section 8 of USEPA SW-846 Method 6010A.

Complete the headed information.

Under "Sample No.", enter the sample numbers of all analytical samples analyzed using the MSA. This includes reruns by MSA.

If additional samples require MSA, submit additional FORMs IX-IN. Samples must be listed in alphanumeric order per analyte, continuing to the next FORM IX-IN if applicable.

Under "Anlyt", enter the chemical symbol for each analyte for which MSA was required for each sample listed. The analytes must be in alphabetic listing of the chemical symbols.

Results for different samples for each analyte must be reported sequentially, with the analytes ordered according to the alphabetic listing of their chemical symbols.

Under "0 ADD ABS", enter the measured value in absorbance units for the analyte before any addition is performed.

Under "1 ADD CON", enter the final concentration in  $\mu\text{g/L}$  of the analyte after the first addition to the sample analyzed by MSA.

Under "1 ADD ABS", enter the measured value of the sample solution spiked with the first addition.

Under "2 ADD CON", enter the final concentration in  $\mu\text{g/L}$  of the analyte after the second addition to the sample analyzed by MSA.

Under "2 ADD ABS", enter the measured value of the sample solution spiked with the second addition.

Under "3 ADD CON", enter the final concentration in  $\mu\text{g/L}$  of the analyte after the third addition to the sample analyzed by MSA.

Under "3 ADD ABS", enter the measured value of the sample solution spiked with the third addition.

Under "Final Conc.", enter the final analyte concentration in the sample as determined by MSA computed according to the following formula:

$$\text{Final Conc.} = -(\text{x intercept})$$

Under "r", enter the correlation coefficient that is obtained for the least squares regression line representing the following points (x,y), (0.0, "0 ADD ABS"), ("1 ADD CON", "1 ADD ABS"), ("2 ADD CON", "2 ADD ABS"), and ("3 ADD CON", "3 ADD ABS").

Under "Q", enter "J" if r is less than 0.995. If r is greater than or equal to 0.995, then leave the field empty.

**FORM X INORGANIC INSTRUMENT DETECTION LIMITS:** This form is required only for Level III B reporting. This form documents the Instrument Detection Limits for each instrument that the laboratory used to obtain data for the Batch Group.

Complete the header information.

Under "IDL", enter the Instrument Detection Limit as determined by the laboratory for each analyte analyzed by the instrument.

Under "M", enter the method of analysis used to determine the instrument detection limit for each wavelength used.

Use additional FORM Xs if more instruments and wavelengths are used.

**FORM XI INORGANIC PREPARATION LOG**: This form is required only for Level III B reporting. This form is used to report the preparation run log. All field samples and all quality control preparations (including duplicates, matrix spikes, LCS's, PB's and re-preparations) associated with the batch group must be reported on FORM XI-INORGANIC.

Complete the header information. For "Prep. Method No.", enter the method for which the preparations listed on the Form were made. Note a separate Form XI must be submitted for each preparation method.

Under "Sample No.", enter the sample number of each sample in the batch, and of all other preparations such as duplicates, matrix spikes, LCSs, PBs, and re-preparations. All Sample numbers must be listed in ascending alphanumeric order, continuing to the next FORM XIs if applicable.

Under "Preparation Date", enter the date on which each sample was prepared for analysis by the method indicated in the header section of the Form.

Under "Weight", enter the wet weight of each soil sample prepared for analysis by the method indicated in the header section of the Form. If the sample matrix is water, then leave the field empty.

Under "Volume", enter the final volume of the preparation for each sample prepared for analysis by the method indicated in the header section of the Form. This field must have a value for each sample listed.

Under "M", enter the method of analysis used to determine the instrument detection limit for each wavelength used.

Use additional FORM Xs if more instruments and wavelengths are used.

**FORM XI INORGANIC PREPARATION LOG:** This form is required only for Level III B reporting. This form is used to report the preparation run log. All field samples and all quality control preparations (including duplicates, matrix spikes, LCS's, PB's and re-preparations) associated with the batch group must be reported on FORM XI-INORGANIC.

Complete the header information. For "Prep. Method No.", enter the method for which the preparations listed on the Form were made. Note a separate Form XI must be submitted for each preparation method.

Under "Sample No.", enter the sample number of each sample in the batch, and of all other preparations such as duplicates, matrix spikes, LCSs, PBs, and re-preparations. All Sample numbers must be listed in ascending alphanumeric order, continuing to the next FORM XIs if applicable.

Under "Preparation Date", enter the date on which each sample was prepared for analysis by the method indicated in the header section of the Form.

Under "Weight", enter the wet weight of each soil sample prepared for analysis by the method indicated in the header section of the Form. If the sample matrix is water, then leave the field empty.

Under "Volume", enter the final volume of the preparation for each sample prepared for analysis by the method indicated in the header section of the Form. This field must have a value for each sample listed.























## ORGANIC REPORTING FORM INSTRUCTIONS

- A. ORGANIC ANALYSIS DATA SHEET (FORM I-ORGANIC): This form is used for tabulating and reporting sample analysis results for Organic compounds.

The laboratory must complete a Form I for each investigative sample, trip blank, method blank, matrix spike, matrix spike duplicate and laboratory control sample analyzed. The laboratory must complete a Form I for each analytical method used to analyze the sample. The results obtained by two analytical methods upon one sample can not be combined on one Form I.

Complete the header information on each page as required.

Under "% moisture not dec.", enter the nondecanted percent moisture.

"Date Received" is the date of sample receipt at the laboratory. It should be entered as MM/DD/YY.

"Date Extracted" and "Date Analyzed" should be entered in a similar fashion. The date of sample receipt should be compared with the extraction and analysis dates of each fraction to ensure that holding times were not exceeded.

If a sample has been diluted for analysis, enter the "Dilution Factor" as a single number, such as 100 for a 1 to 100 dilution of the sample. Enter 0.1 for a concentration of 10 to 1. If the sample was not diluted, enter 1.

Report the concentrations uncorrected for blank contaminants.

Report analytical results to two significant figures

The appropriate concentration units, ug/L or ug/kg, must be entered.

If the result is a value greater than or equal to the quantitation limit, report the value. If the result is less than the quantitation limit, report the value as indicated in Section 6.3 of the Analytical Quality Assurance Plan (AQAP).

Under the column labeled "Q" for qualifier, flag each result with the specific data flags as listed in Section 6.3 of the AQAP.

- B. SURROGATE RECOVERY (FORM II-ORGANIC): This FORM II is used to report the recoveries of the surrogate compounds added to each sample, blank, matrix spike, and matrix spike duplicate.

Complete the header information.

For each surrogate, report the percent recovery to the one significant figure using the following equation:

$$\% \text{ Recovery} = \frac{\text{Concentration (or amount) Found}}{\text{Concentration (or amount) Found}} \times 100$$

At the bottom of the form indicate the surrogates used, list both the full name and the abbreviation used at the top of the columns. List the QC limits applied (listed in section 7.2 of the AQAP).

Flag each surrogate recovery outside the QC limits, listed in section 7.2 of the AQAP, with an asterisk (\*). The asterisk must be placed in the last space in each appropriate column, under the "#" symbol. In the far righthand column, total the number of surrogate recoveries outside the QC limits for each sample. If no surrogates were outside the limits, enter "0".

If the surrogates are diluted out in any analysis, enter the calculated recovery or "0" if the surrogate is not detected, and flag the surrogate recoveries with a "D" in the column under the "#" symbol. Don't include results flagged "D" in the total number of recoveries for each sample outside the QC limits.

C. MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY (FORM III-ORGANIC): This form is used to report the results of the analyses of a matrix spike and matrix spike duplicate.

Complete the header information.

In the upper box in Form III, under "Spike Added", enter the calculated concentration in ug/L or ug/kg (according to the matrix) that results from adding each spiked compound to the aliquot chosen for the matrix spike (MS). For instance, if 100ug of spike are added to 1g of soil, the resulting concentration is 100,000 ug/kg. Enter the "Sample Concentration", in similar units, of each spike compound detected in the original sample. If a spike compound was not detected during the analysis of the original sample, enter the sample result as "0". Under "MS Concentration", enter the actual concentration of each spike compound detected in the matrix spike aliquot. Calculate the percent recovery of each spike compound in the matrix spike aliquot using the following equation:

$$\% R (\text{Matrix Spike}) = \frac{SSR - SR}{SA} \times 100$$

Report the recovery to the nearest whole percent, and enter under "MS % REC". Flag all percent recoveries outside the QC limits, listed in section 7.2 of the AQAP, with an asterisk (\*). The asterisk must be placed in the last space of the percent recovery column, under the "#" symbol.

Complete the lower box of Form III in a similar fashion, using the results of the analysis of the matrix

spike duplicate (MSD) aliquot. Calculate the relative percent difference (RPD) between the matrix spike recovery and the matrix spike duplicate recovery using the following equation:

$$RPD = \frac{|MSR - MSDR|}{\left(\frac{MSR + MSDR}{2}\right)} \times 100$$

and enter this value in the lower box under "%RPD". Compare the RPDs to the QC limits listed in section 7.2 of the AQAP, and flag each RPD outside the QC limits with an asterisk (\*) in the last space of the "% RPD" column, under the "#" symbol.

Summarize the values outside the QC limits at the bottom of the page.

- D. METHOD BLANK SUMMARY (FORM IV-ORGANIC): This form summarizes the samples associated with each method blank analysis. A copy of the appropriate Form IV is required for each blank.

Complete the header information.

For volatile blanks, enter the method number of sample introduction procedure in the space provided for "Extraction Procedure No". For other method blanks, enter the extraction procedure number.

For all fractions, as appropriate, summarize the samples associated with a given method blank in the table below the header, entering the program participant (client) Sample Number, and Lab Sample ID.

Enter the Lab File No. and time of analysis of each sample.

- E. GC/MS TUNING AND MASS CALIBRATION (FORM VA-ORGANIC AND FORM VB-ORGANIC): These forms are used to report the results of GCMS tuning for volatiles and semivolatiles, and to summarize the date and time of analysis of samples, standards, blanks, matrix spikes, and matrix spike duplicates associated with each GCMS tune.

Complete the header information. Enter the "Lab File ID" for the injection containing the GC/MS tuning compound (BFB for volatiles, DFTPP for semivolatiles). Enter the "Instrument ID". Enter the date and time of injection of the tuning compound. Enter the type of GC column used as "PACK" or "CAP", under "Column."

For each ion listed on the form, enter the percent relative abundance in the righthand column. Report relative abundances to the number of significant figures given for each ion in the ion abundance criteria column.

All relative abundances must be reported as a number. If zero, enter "0", not a dash or other non-numeric character. Where parentheses appear, compute the percentage of the ion abundance of the mass given in the appropriate footnote, and enter that value in the parentheses.

In the lower half of the form, list all samples, standards, blanks, matrix spikes, and matrix spike duplicates analyzed under that tune in chronological order, by time of analysis. Enter "Sample No.", "Lab Sample ID", "Lab File No.", "Date Analyzed", and "Time Analyzed" for all standards, samples, blanks, matrix spikes, and matrix spike duplicates.

The GC/MS tune expires twelve hours from the time of injection of the tuning compound (BFB or DFTPP) listed at the top of the form. In order to meet the tuning requirements, a sample, standard, blank, matrix spike, or matrix spike duplicate must be injected within twelve hours of the injection of the tuning compound.

F. INITIAL CALIBRATION DATA (FORM VIA-ORGANIC AND VIB-ORGANIC):

After an analytical system has undergone an initial calibration, and after all initial calibration criteria have been met, the laboratory must complete and submit a Form VIA or VIB for each initial calibration performed which is relevant to the samples, blanks, matrix spikes, matrix spike duplicates in the delivery group, regardless of when that calibration was performed.

Complete all header information. If the calendar date changes during the calibration procedure, the inclusive dates should be given on the Form. Complete the response factor or calibration factor data for the calibration points, and then calculate and report the average relative response factor (RRF) or average calibration factor (CF) for all target and surrogate compounds. The laboratory must report the %RSD for all compounds. For GC/MS analyses all CCC compounds must have a %RSD of less than or equal to 30.0 percent. All VOA SPCC compounds must have a minimum average relative response factor (RRF) of 0.300 (0.250 for Bromoform). All semivolatile (BNA) SPCC compounds must have a minimum average relative response factor (RRF) of 0.050.

G. CONTINUING CALIBRATION DATA (FORM VIIA-ORGANIC):

The Continuing Calibration Data Form is used to report the verification of the calibration of the analytical system by the analysis of specific calibration standards. A Continuing Calibration Data Form is required for each twelve (12) hour time period for analyses.

For GC/MS analyses, after meeting specific criteria for both SPCC and CCC compounds, a Continuing Calibration Data Form must be completed and submitted.

Complete all header information. Using the appropriate Initial Calibration fill in the average relative response factor (RRF) or average calibration factor (CF) for all target and surrogate compounds.

Report the relative response factor (RRF) or calibration factor (CF) from the continuing calibration standard analysis. Calculate the Percent Difference (%D) for all compounds. For GC/MS CCC compounds analysis, ensure that the %D is less than or equal to 25.0 percent. After this criterion has been met, report the Percent Difference for all target and surrogate compounds.

H. INTERNAL STANDARD AREA SUMMARY (FORM VIII-ORGANIC):

This form is used to summarize the peak areas of the internal standards when required to be added samples, blanks, matrix spikes, and matrix spike duplicates. The data is used to determine when changes in internal standard responses will adversely affect quantification of target compounds. When internal standardization is used this form must be completed each time a continuing calibration is performed, or when samples are analyzed under the same GC/MS tune as an initial calibration.

Complete the header information. For GC/MS analyses, if samples are analyzed immediately following an initial calibration, before another GC/MS tune and a continuing calibration, Form VIII shall be completed on the basis of the internal standard areas of the 50 ug/L initial calibration standard for volatiles, and the 50 ng initial calibration standard for semivolatiles. Use the date and time of analysis of this standard in place of those of a continuing calibration standard.

From the results of the analysis of the continuing calibration standard, enter the area measured for each internal standard and its retention time under the appropriate column in the row labeled "12 HOUR STD". For each internal standard, calculate the upper limit as the area of the particular standard plus 100% of its area (i.e., two times the area in the 12 HOUR STD box), and the lower limit as the area of the internal standard minus 50% of its area (i.e., one half the area in the 12 HOUR STD box). Report these values in the boxes labeled "UPPER LIMIT" and "LOWER LIMIT" respectively.

For each sample, blank, matrix spike, and matrix spike duplicate analyzed under a given continuing calibration, enter the Sample Number and the area measured for each internal standard and its retention time. If the internal standard area is outside the upper or lower limits calculated above, flag that area with an asterisk (\*). The asterisk must be placed in the far right hand space of the box for each internal standard area, directly under the "#" symbol.

Report the relative response factor (RRF) or calibration factor (CF) from the continuing calibration standard analysis. Calculate the Percent Difference (%D) for all compounds. For GC/MS CCC compounds analysis, ensure that the %D is less than or equal to 25.0 percent. After this criterion has been met, report the Percent Difference for all target and surrogate compounds.

#### H. INTERNAL STANDARD AREA SUMMARY (FORM VIII-ORGANIC):

This form is used to summarize the peak areas of the internal standards when required to be added samples, blanks, matrix spikes, and matrix spike duplicates. The data is used to determine when changes in internal standard responses will adversely affect quantification of target compounds. When internal standardization is used this form must be completed each time a continuing calibration is performed, or when samples are analyzed under the same GC/MS tune as an initial calibration.

Complete the header information. For GC/MS analyses, if samples are analyzed immediately following an initial calibration, before another GC/MS tune and a continuing calibration, Form VIII shall be completed on the basis of the internal standard areas of the 50 ug/L initial calibration standard for volatiles, and the 50 ng initial calibration standard for semivolatiles. Use the date and time of analysis of this standard in place of those of a continuing calibration standard.

From the results of the analysis of the continuing calibration standard, enter the area measured for each internal standard and its retention time under the appropriate column in the row labeled "12 HOUR STD". For each internal standard, calculate the upper limit as the area of the particular standard plus 100% of its area (i.e., two times the area in the 12 HOUR STD box), and the lower limit as the area of the internal standard minus 50% of its area (i.e., one half the area in the 12 HOUR STD box). Report these values in the boxes labeled "UPPER LIMIT" and "LOWER LIMIT" respectively.

For each sample, blank, matrix spike, and matrix spike duplicate analyzed under a given continuing calibration, enter the Sample Number and the area measured for each internal standard and its retention time. If the internal standard area is outside the upper or lower limits calculated above, flag that area with an asterisk (\*). The asterisk must be placed in the far right hand space of the box for each internal standard area, directly under the "#" symbol.



FORM II  
 IEPA SITE REMEDIATION PROGRAM  
 ORGANIC SURROGATE RECOVERY SHEET

IEPA LPC No.:	SITE NAME:
Lab Name:	Batch No.:
Matrix: (soil/water)	Analytical Method No.:
IEPA Site Remediation Program Data Quality Level IIIA \ IIIB (circle one)	

	SAMPLE NO.	S1 ( )#	S2 ( )#	S3 ( )#	S4 ( )#	S5 ( )#	S6 ( )#	S7 ( )#	S8 ( )#
01									
02									
03									
04									
05									
06									
07									
08									
09									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									

	<b>Surrogate</b>		<b>QC Limits</b>
S1 ( )	=	_____	_____
S2 ( )	=	_____	_____
S3 ( )	=	_____	_____
S4 ( )	=	_____	_____
S5 ( )	=	_____	_____
S6 ( )	=	_____	_____
S7 ( )	=	_____	_____
S8 ( )	=	_____	_____

FORM III  
 IEPA SITE REMEDIATION PROGRAM  
 ORGANIC MATRIX SPIKE / MATRIX SPIKE DUPLICATE RECOVERY SHEET

IEPA LPC No.:	SITE NAME:
Lab Name:	Batch No.:
Matrix: (soil/water)	Analytical Method No.:
IEPA Site Remediation Program Data Quality Level IIIA \ IIIB (circle one)	

Compound	Spike Added (ug/L)	Sample Concentration (ug/L)	MS Concentration (ug/L)	MS % Recvry #	QC % R

Compound	Spike Added (ug/L)	MSD Concentration (ug/L)	MSD % Recvry	% RPD #	QC Limits	
					RPD	% R

# Column to be used to flag recovery and RPD values with an asterisk  
 • Values outside of QC limits

Comments:

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FORM IV  
 IEPA SITE REMEDIATION PROGRAM  
 ORGANIC METHOD BLANK SUMMARY SHEET

IEPA LPC No.:	SITE NAME:
Lab Name:	Batch No.:
Matrix (soil/water)	Lab Sample ID:
Analytical Method No.:	Date Extracted:
Extraction Procedure No.:	Date Analyzed:
	Time Analyzed:
IEPA Site Remediation Program Data Quality Level IIIA \ IIIB (circle one)	

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS AND MSD

	Lab Sample ID:	Lab File ID.	Time Analyzed
01			
02			
03			
04			
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
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22			
23			
24			
25			
26			
27			
28			
29			
30			

FORM VA  
 IEPA SITE REMEDIATION PROGRAM  
 VOLATILE ORGANICS GC/MS INSTRUMENT PERFORMANCE CHECK  
 BROMOFLUOROBENZENE

IEPA LPC No.:	SITE NAME:
Lab Name:	Batch No.:
Lab File ID:	BFB Injection Date:
Instrument ID:	BFB Injection Time:
IEPA Site Remediation Program Data Quality Level IIIA \ IIIB (circle one)	

m/e	Ion Abundance Criteria	% Relative Abundance
50	8.0 - 40.0 % of mass 95	
75	30.0 - 66.0 % of mass 95	
95	Base peak, 100 % relative abundance	
96	5.0 - 9.0 % of mass 95	
173	Less than 2.0 % of mass 174	( )
174	50.0 - 120.0 of mass 95	
175	4.0 - 9.0 % of mass 174	( )
176	93.0 - 101.0 % of mass 174	( )
177	5.0 - 9.0 % of mass 176	( )

1 - Value is % of mass 174

2-Value is % of mass 176

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

#	Lab Sample ID	Lab File ID	Date Analyzed	Time Analyzed
01				
02				
03				
04				
05				
06				
07				
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FORM 100  
 EPA Site Remediation PROGRAM  
 SEMIVOLATILE ORGANICS GC/MS INSTRUMENT PERFORMANCE CHECK  
 DECAFLUOROTRIPHENYLPHOSPHINE (DFTPP)

IEPA LPC No.:	SITE NAME
Lab Name:	Batch No.:
Lab File ID:	BFB Injection Date:
Instrument ID:	BFB Injection Time:
IEPA Site Remediation Program Data Quality Level IIIA \ IIIB (circle one)	

m/e	Ion Abundance Criteria	% Relative Abundance
51	30.0 - 80.0 % of mass 198	
68	Less than 2.0 % of mass 69	1
69	Mass 69 relative abundance	
70	Less than 2.0 % of mass 69	1
127	25.0 - 75.0 % of mass 198	
197	less than 1.0 % of mass 198	
198	Base Peak 100 % relative abundance	
199	5.0 - 9.0 % of mass 198	
275	10.0 - 30.0 % of mass 198	
365	Greater than 0.75 % of mass 198	
441	Present, but less than mass 443	
442	40.0 - 110.0 % of mass 198	
443	15.0 - 24.0 % of mass 442	1

1-Value is % of mass 69

2-Value is % of mass 442

THIS CHECK APPLIES TO THE FOLLOWING SAMPLES, MS, MSD, BLANKS, AND STANDARDS:

#	Lab Sample ID	Lab File ID	Date Analyzed	Time Analyzed
01				
02				
03				
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**Attachment B**

*Attachment 1*

*SOP for Soil Sample Collection*

ATTACHMENT 1  
STANDARD OPERATING PROCEDURE  
FOR  
SOIL SAMPLE COLLECTION

A variety of samplers (split-barrel, split-barrel with brass liners, backhoe, or shovel) will be used to retrieve soil from sampling locations. Depending on the analysis to be conducted on the soil sample, the soil sample will either be sealed within the sampler (e.g., collecting volatile samples) or the soil sample will be transferred to laboratory-supplied containers. The equipment required to transfer the soil from the sampler to the laboratory-supplied sample containers includes: stainless steel spoons or scoops and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the Health and Safety Plan.

All soil sampling equipment will be carefully cleaned before and during soil sampling. All sampling tools including split-barrel stainless steel spoons and scoops will be cleaned before use and between samples in the following manner: (1) clean with tap water and TSP, using a brush if necessary to remove particulate matter and films, or (2) rinse thoroughly with tap water. Brass liners will be supplied by the laboratory and transported to the site wrapped in aluminum foil. To prevent sample cross-contamination, the sampler will discard the outer pair of sample gloves and put on a new pair between each sample event.

Collecting Volatile Samples. Soil samples collected for volatile analysis will be retrieved from the sampling location with one of the following: drilling rig equipped with a split-barrel sampler with brass liners, a backhoe, or a hand-auger and a split-barrel rod sampling assembly.

The following procedure applies to soil samples retrieved with a drilling rig equipped with a split-barrel sampler with brass liners:

1. Open the split-barrel sampler.
2. Remove one of the two 6-inch long brass liners that are within the split-barrel. If sample recovery has not fully filled both brass liners, remove the fullest of the two liners.
3. Add additional soil to both ends of the brass liner, if necessary, to eliminate headspace.
4. Cover both ends of the brass liner with two sheets of aluminum foil. Cover the aluminum foil with a plastic cap.
5. Cool the sample to approximately 4°C immediately after collection.

The following procedure applies to soil samples retrieved with a backhoe:

1. Remove the aluminum foil from one brass liner.
2. Scrape off the outer few inches of soil in the backhoe bucket to expose a fresh surface.
3. Immediately push the brass liner into the soil in the bucket. Fill the brass liner entirely with soil.
4. Add additional soil to both ends of the brass liner, if necessary, to eliminate headspace.

5. Cover both ends of the brass liner with two sheets of aluminum foil. Seal the ends by covering the aluminum foil with a plastic cap.
6. Cool the sample to approximately 4°C immediately after collection.

The following procedure applies to the collection of hand-augered soil samples:

1. Auger to the desired sampling interval.
2. Remove the aluminum foil from two of the brass liners. Place the liners into a split-barrel sampler equipped with a sand trap.
3. Screw the split-barrel sampler to the rod.
4. Place the sampling assembly into the hand-augered hole.
5. Pound the rod the length of the sampling interval using a post setter.
6. Remove the sampling assembly from the hole and unscrew the split-barrel sampler from the rod.
7. Open the split-barrel sampler and remove one of the brass liners. If sample recover has not fully filled both brass liners, remove the fullest of the two liners.
8. Add additional soil to both ends of the brass liner, if necessary, to eliminate head space.

9. Cover both ends of the brass liner with two sheets of aluminum foil. Seal the ends by covering the aluminum foil with a plastic cap.
10. Cool the sample to approximately 4°C immediately after collection.

If the hand-auger and split-barrel with rod sampling method does not result in an adequate amount of soil sample to fill one brass liner, then the following method will be used:

1. Auger to the top of the desired sampling interval.
2. Remove the auger from the borehole and wipe off the auger flights.
3. Replace the auger and drill the length of the sampling interval.
4. Remove the auger from the borehole.
5. Using a stainless steel spoon, quickly scrape the soil from the auger flights and fill two laboratory-supplied, 2-ounce, wide-mouth glass jars with Teflon-lined caps. Fill the sample containers completely, eliminating any headspace.
6. Cool the sample to approximately 4°C immediately after collection.

Collecting Semivolatile, PCB, and Pesticide Samples.

1. The semivolatile, PCB, and pesticide soil samples will each be collected in one laboratory-supplied, 8-ounce, wide-mouth glass jar with a Teflon-lined cap.

2. The sample container will be filled to three-quarters full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting Metals and Cyanide Samples.

1. The metals and cyanide soil samples will be collected in one laboratory-supplied, 8-ounce, wide-mouth glass jar.
2. The sample containers will be filled to three-quarters full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting TCLP Samples.

1. The TCLP soil samples will be collected in two laboratory-supplied, one-quart glass jars.
2. The sample containers will be filled full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting Gross Heating Value Samples.

1. The gross heating value soil samples will be collected in one laboratory-supplied pint size wide mouth glass jar.

2. The sample container will be filled full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting Flashpoint Samples.

1. The flashpoint soil samples will be collected in one laboratory-supplied pint-size wide mouth glass jar.
2. The sample container will be filled full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Sample Storage. Immediately after samples are collected, they will be put into a cooler containing ice or ice packs. Samples will be kept cold (approximately 4°C) until receipt at the laboratory, where they are to be stored in a refrigerated area. All samples will be kept secured to prevent tampering. The coolers will be sealed with signed and dated tamper-proof tape. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

**Attachment B**

ATTACHMENT 1

STANDARD OPERATING PROCEDURE  
FOR  
SOIL SAMPLE COLLECTION

A variety of samplers (split-barrel, split-barrel with brass liners, backhoe, or shovel) will be used to retrieve soil from sampling locations. Depending on the analysis to be conducted on the soil sample, the soil sample will either be sealed within the sampler (e.g., collecting volatile samples) or the soil sample will be transferred to laboratory-supplied containers. The equipment required to transfer the soil from the sampler to the laboratory-supplied sample containers includes: stainless steel spoons or scoops and the appropriate personal protective equipment necessary for collection and handling of soil samples as described in the Health and Safety Plan.

All soil sampling equipment will be carefully cleaned before and during soil sampling. All sampling tools including split-barrel stainless steel spoons and scoops will be cleaned before use and between samples in the following manner: (1) clean with tap water and TSP, using a brush if necessary to remove particulate matter and films, or (2) rinse thoroughly with tap water. Brass liners will be supplied by the laboratory and transported to the site wrapped in aluminum foil. To prevent sample cross-contamination, the sampler will discard the outer pair of sample gloves and put on a new pair between each sample event.

Collecting Volatile Samples. Soil samples collected for volatile analysis will be retrieved from the sampling location with one of the following: drilling rig equipped with a split-barrel sampler with brass liners, a backhoe, or a hand-auger and a split-barrel rod sampling assembly. The sample collection methods are consistent with IEPA procedures.

The following procedure applies to soil samples retrieved with a drilling rig equipped with a split-barrel sampler with brass liners:

1. Open the split-barrel sampler.
2. Remove one of the two 6-inch long brass liners that are within the split-barrel. If sample recovery has not fully filled both brass liners, remove the fullest of the two liners.
3. Add additional soil to both ends of the brass liner, if necessary, to eliminate headspace.
4. Cover both ends of the brass liner with two sheets of aluminum foil. Cover the aluminum foil with a plastic cap.
5. Cool the sample to approximately 4°C immediately after collection.

The following procedure applies to soil samples retrieved with a backhoe:

1. Remove the aluminum foil from one brass liner.
2. Scrape off the outer few inches of soil in the backhoe bucket to expose a fresh surface.
3. Immediately push the brass liner into the soil in the bucket. Fill the brass liner entirely with soil.
4. Add additional soil to both ends of the brass liner, if necessary, to eliminate headspace.
5. Cover both ends of the brass liner with two sheets of aluminum foil. Seal the ends by covering the aluminum foil with a plastic cap.
6. Cool the sample to approximately 4°C immediately after collection.

The following procedure applies to the collection of hand-augered soil samples:

1. Auger to the desired sampling interval.
2. Remove the aluminum foil from two of the brass liners. Place the liners into a split-barrel sampler equipped with a sand trap.
3. Screw the split-barrel sampler to the rod.
4. Place the sampling assembly into the hand-augered hole.
5. Pound the rod the length of the sampling interval using a post setter.
6. Remove the sampling assembly from the hole and unscrew the split-barrel sampler from the rod.
7. Open the split-barrel sampler and remove one of the brass liners. If sample recover has not fully filled both brass liners, remove the fullest of the two liners.
8. Add additional soil to both ends of the brass liner, if necessary, to eliminate head space.
9. Cover both ends of the brass liner with two sheets of aluminum foil. Seal the ends by covering the aluminum foil with a plastic cap.
10. Cool the sample to approximately 4°C immediately after collection.

If the hand-auger and split-barrel with rod sampling method does not result in an adequate amount of soil sample to fill one brass liner, then the following method will be used:

1. Auger to the top of the desired sampling interval.
2. Remove the auger from the borehole and wipe off the auger flights.

3. Replace the auger and drill the length of the sampling interval.
4. Remove the auger from the borehole.
5. Using a stainless steel spoon, quickly scrape the soil from the auger flights and fill two laboratory-supplied, 2-ounce, wide-mouth glass jars with Teflon-lined caps. Fill the sample containers completely, eliminating any headspace.
6. Cool the sample to approximately 4°C immediately after collection.

Collecting Semivolatile, PCB, and Pesticide Samples.

1. The semivolatile, PCB, and pesticide soil samples will each be collected in one laboratory-supplied, 8-ounce, wide-mouth glass jar with a Teflon-lined cap.
2. The sample container will be filled to three-quarters full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting Metals and Cyanide Samples.

1. The metals and cyanide soil samples will be collected in one laboratory-supplied, 8-ounce, wide-mouth glass jar.
2. The sample containers will be filled to three-quarters full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting TCLP Samples.

1. The TCLP soil samples will be collected in two laboratory-supplied, one-quart glass jars.
2. The sample containers will be filled full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting Gross Heating Value Samples.

1. The gross heating value soil samples will be collected in one laboratory-supplied pint size wide mouth glass jar.
2. The sample container will be filled full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Collecting Flashpoint Samples.

1. The flashpoint soil samples will be collected in one laboratory-supplied pint-size wide mouth glass jar.
2. The sample container will be filled full using a stainless steel spoon or scoop.
3. Cool the sample to approximately 4°C immediately after collection.

Sample Storage. Immediately after samples are collected, they will be put into a cooler containing ice or ice packs. Samples will be kept cold (approximately 4°C) until receipt at the laboratory, where they are to be stored in a refrigerated area. All samples will be kept secured to prevent tampering. The coolers will be sealed with signed and dated tamper-proof

tape. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

# Barr

Engineering Company

8300 Norman Center Drive  
Minneapolis, MN 55437-1026  
Phone: (612) 832-2600  
Fax: (612) 835-0186

December 16, 1991

Ms. Cindy J. Nolan, HSRL-6J  
U.S. Environmental Protection Agency  
77 West Jackson Boulevard  
Chicago, IL 60604

Re: Waukegan Manufactured Gas and Coke Plant Site  
Modifications/Additions to Phase I Investigation Procedures

Dear Ms. Nolan:

The schedule for implementing field investigations at the above-referenced site is outlined in the October 24, 1991 Final Work Plan. Based on the November 21, 1991 receipt of your letter approving the work plan, Phase I field work is scheduled to begin the week of January 13, 1992. A site visit during the week of January 6, 1992 will be necessary to mark sampling locations and set up the field office. Implementation of this schedule will depend on timely resolution of site access issues and on receiving final approval of the Quality Assurance Project Plan prior to the commencement of on-site activities on January 6, 1992.

The Final Work Plan and associated documents detailed sampling methods for the Phase I investigation. In the case of sampling to be done with a hand auger, implementation will be difficult for Phase I activities performed during the winter. For other proposed procedures, additional details regarding methods have been determined since preparation of the final work plan. The following modifications/additions to the planned procedures are proposed to allow effective winter implementation of the work plan:

- Due to difficulties anticipated for hand augering in frozen soils, all background soil samples (Subtask I.3) and surficial soil samples (Subtask I.4) will be collected using hollow-stem auger drilling equipment and split-spoon samplers.
- Because surficial soil samples will be collected using split-spoon sampling equipment rather than hand augers, more detailed soil characterization information will be available for each sampling location. Therefore, the auxiliary test trenches designed to provide supplementary soil characterization information will not be placed.
- All soil samples for analysis of volatile organic compounds will be collected in a single brass liner held against the shoe end of the split-spoon sampler by a bead or ring on the inner radius of the sampler.

- As described in the Field Sampling Plan, decontamination procedures may involve the use of solvents to remove coal tar from sampling equipment. A methanol or hexane rinse, followed by air drying and steam cleaning, will be used to clean equipment if steam cleaning and detergent do not remove all visible contamination. If a solvent rinse is used to clean drilling equipment, these procedures will be performed over a nonleaking mud tank, cattle trough, or other similar basin. Rinsate will be collected and containerized.

I will call you this week to confirm your approval of these modifications/ additions prior to their implementation. In the interim, please call Jim Langseth or me if you have any questions.

Sincerely,

Michael M. Relf

MMR:crs

c: Pat Doyle

Russ Selman

13\49\003\WCPPHI.LTR



Outboard Marine Corporation  
Environmental Affairs Dept.

190 Sea Horse Drive  
Waukegan, IL 60085-2141  
Fax: 847/689-5684  
Office Telephone: 847/689-5268

## FACSIMILE TRANSMISSION COVER SHEET

PLEASE DELIVER THE FOLLOWING PAGE(S) TO:

NAME: Mike Bellot

LOCATION: EPA

FAX NUMBER: (312) 353-5541 Phone (312) 353-6425

DATE: May 28 1998

FROM: Marc Willis

SENDER'S DIRECT DIAL TELEPHONE NUMBER: 847/689-5574

TOTAL NUMBER OF PAGES, INCLUDING COVER SHEET: 10

REMARKS: Here is a data summary of the analytical results from the parking lot expansion soil sampling. Please contact Roger Crawford or myself to discuss the matter further.

Thanks, \_\_\_\_\_

Marc Willis \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



OUTBOARD MARINE CORPORATION

100 Sea Horse Drive  
Waukegan, Illinois 60085-2195  
Phone 847/689-6200

May 28, 1998

Mike E. Bellot  
Remedial Project Manager  
U.S. Environmental Protection Agency  
77 West Jackson Blvd.  
Chicago, Illinois 60604-3590

**RE: OMC Waukegan Plant No. 1 Parking Lot Expansion Analytical Data.**

Mr. Bellot,

OMC has received the analytical results from the near surface soil samples collected at the parking lot expansion area. Attached to this letter is a summary of the data, a sample location map, and soil investigation logs.

We look forward to discussing this matter in more detail with you as soon as possible and will seek to resolve any questions you may have.

Sincerely,



Marc A. Willis  
Environmental Specialist

**Attachments**

cc: M. Cannon  
R. Crawford  
T. Elsen  
J. Moran  
S. Mulroney

\*\* TX CONFIRMATION REPORT \*\*

AS OF MAY 29 '98 14:49 PAGE.01

OMC ENVIR AFFRS

	DATE	TIME	TO/FROM	MODE	MIN/SEC	PGS	CMD#	STATUS
22	05/28	14:44	312 353 4788	EC--S	05'13"	010		OK

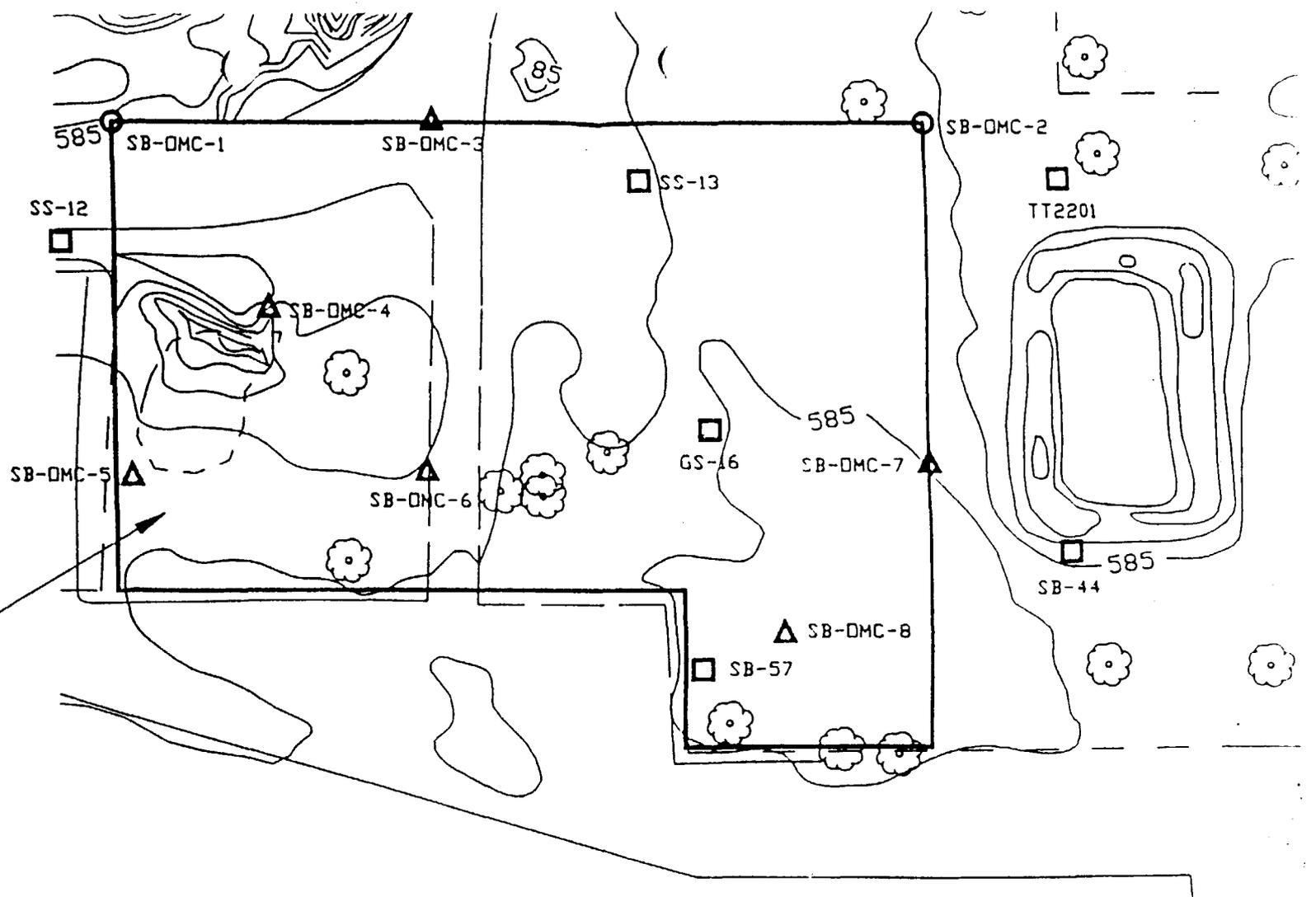
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Soil Investigation Log  
 OMC Waukegan Plant 1  
 Parking Lot Expansion  
 5/11/98

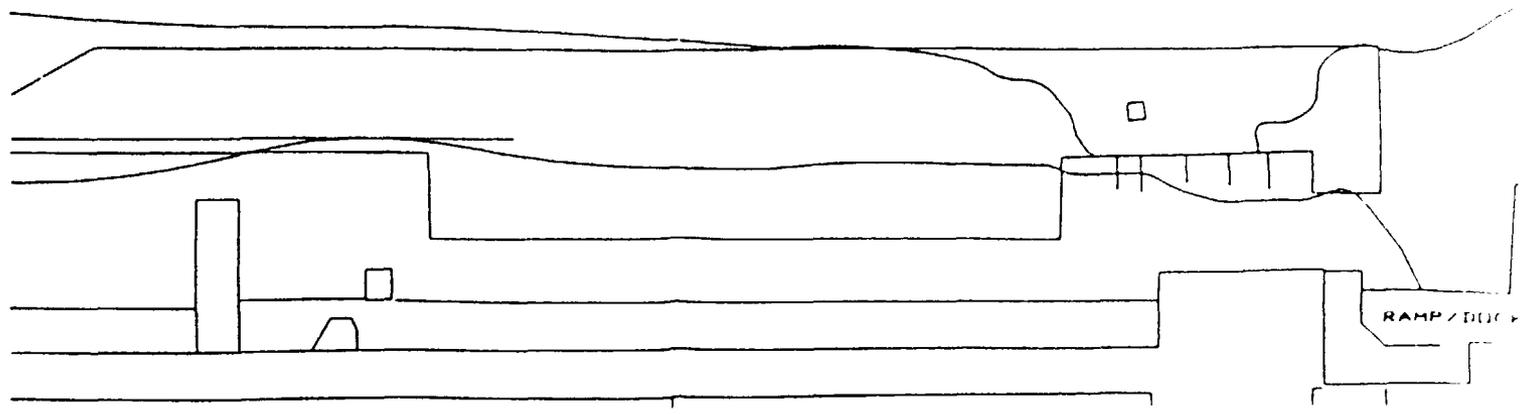
Location	Depth Interval (ft)	Recovery (ft)	Description
SB-OMC-1	0 - 2	2.0	(SP) SAND, fine to medium, trace silt, gray. Encountered water and coal fragments at 1.7'. No odor.
	2 - 4	1.0	(SP) SAND, fine to medium, wet, gray, large coal fragments. No odor.
SB-OMC-2	0 - 2	2.0	Coarse grained coal, little fine sand, black, moist. Wet at 1.5'. No odor.
	2 - 4	1.5	Coarse grained coal, little fine sand, black, moist. No odor.
SB-OMC-3	0 - 2	1.5	(SP) SAND, fine, little silt, gray, dry. Root near top, from 0.5' to 1.5' coal layer. Wet at 1.4'. No odor.
SB-OMC-4	0 - 2	2.0	(SP) SAND, fine, trace silt, gray, dry. Some coal fragments at 1.0'. Wet at 1.7'. No odor.
SB-OMC-5	0 - 2	1.7	(SP) SAND, fine, trace silt, gray, dry. Coal fragments at 0.8-1.2'. Wet at 1.5'. No odor.
SB-OMC-6	0 - 2	1.5	(SP) SAND, fine to coarse, trace silt, trace gravel, dry. Coal fragments and road base. No odor.
SB-OMC-7	0 - 2	1.5	(SP) SAND, fine to coarse, trace silt, gray, moist. Coal at 0.8-1.4'. No odor.
SB-OMC-8	0 - 2	1.6	(SP) SAND, fine to medium, trace silt, gray, moist. Coal layer at 1.0-1.4'. No odor.

- Proposed surface and subsurface soil sample locations (1 to 2 ft. bgs) & (2 to 4ft. bgs)
- ▲ Proposed surface soil sample locations (1 to 2 ft. bgs)
- Existing soil sampling locations
- Sample locations are approximate

PROPOSED PARKING LOT



OUTBOARD MARINE CORP.  
 Proposed Parking Lot  
 Waukegan Plant No. 1  
 Waukegan, Illinois



( Near Surface I PAH Results ( )  
 Parking Lot Expansion  
 Outboard Marine Corporation  
 Waukegan Plant 1

CAS No.	Compound	IEPA TACO	SB-OMC-1A		SB-OMC-1B		SB-OMC-2A		SB-OMC-2B		SB-OMC-3		SB-OMC-4	
		Tier 1/Cons. Worke	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q
91-20-3	Naphthalene	8200000 <sup>a</sup>	330	U	330	U	24,700		335		1,820		1,290	
208-96-8	Acenaphthylene		330	U	330	U	53,600		330	U	690		821	
83-32-9	Acenaphthene	120000000 <sup>a</sup>	330	U	330	U	5,100		330	U	377		330	U
86-73-7	Fluorene	82000000 <sup>a</sup>	330	U	330	U	86,300		330	U	631		357	
85-01-8	Phenanthrene		330	U	514		365,000		1,170		6,490		2,870	
120-12-7	Anthracene	610000000 <sup>a</sup>	330	U	330	U	135,000		330	U	960		662	
206-44-0	Fluoranthene	82000000 <sup>a</sup>	557		630		344,000		392		5,610		4,060	
129-00-0	Pyrene	61000000 <sup>a</sup>	330	U	355		163,000		330	U	3,260		2,300	
56-55-3	<b>Benzo[a]anthracene</b>	170000 <sup>a</sup>	330	U	330	U	144,000		330	U	2,560		1,820	
218-01-9	<b>Chrysene</b>	17000000 <sup>a</sup>	361		380		144,000		387		3,000		2,130	
205-99-2	<b>Benzo[b]fluoranthene</b>	170000 <sup>a</sup>	330	U	330	U	110,000		330	U	3,930		2,840	
207-08-9	<b>Benzo[k]fluoranthene</b>	1700000 <sup>a</sup>	330	U	330	U	86,500		330	U	2,350		2,000	
50-32-8	<b>Benzo[a]pyrene</b>	17000 <sup>a</sup>	330	U	330	U	<b>86,500</b>		330	U	2,520		1,890	
193-39-5	<b>Indeno[1,2,3-cd]pyrene</b>	170000 <sup>a</sup>	330	U	330	U	22,000		330	U	835		591	
53-70-3	<b>Dibenz[a,h]anthracene</b>	17000 <sup>a</sup>	330	U	330	U	10,700		330	U	414		330	U
191-24-2	Benzo[g,h,i]perylene		330	U	330	U	15,900		330	U	712		468	
86-74-8	<b>Carbazole</b>	6200000 <sup>a</sup>	330	U	330	U	41,200		330	U	521		330	U
132-64-9	Dibenzofuran		330	U	330	U	31,000		330	U	1,640		609	
91-57-6	2-Methylnaphthalene		330	U	380		19,300		449		3,730		1,620	
95-48-7	o-Cresol	100000000 <sup>a</sup>	330	U	330	U	3,600		330	U	330	U	330	U
106-44-5	m&p-Cresol		330	U	330	U	14,200		1,140		330	U	330	U
105-67-9	2,4-Dimethylphenol	41000000 <sup>a</sup>	330	U	330	U	3,300	U	330	U	330	U	330	U
108-95-2	Phenol	120000000 <sup>a</sup>	330	U	330	U	17,400		2,020		330	U	330	U

Q - qualifier

U - Undetected, Bold Compounds are carcinogenic PAHs

a - Ingestion Pathway

( Near Surface PAH Results ( )  
 Parking Lot Expansion  
 Outboard Marine Corporation  
 Waukegan Plant 1

CAS No.	Compound	IEPA TACO	SB-OMC-4D		SB-OMC-5		SB-OMC-6		SB-OMC-7		SB-OMC-8	
		Tier 1/Cons. Worke	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q
91-20-3	Naphthalene	8200000 <sup>a</sup>	805		345		1,220		330	U	872	
208-96-8	Acenaphthylene		774		330	U	524		330	U	330	U
83-32-9	Acenaphthene	120000000 <sup>a</sup>	330	U	330	U	330	U	330	U	330	U
86-73-7	Fluorene	82000000 <sup>a</sup>	327	J	330	U	330	U	330	U	330	U
85-01-8	Phenanthrene		2,400		536		3,310		534		3,100	
120-12-7	Anthracene	610000000 <sup>a</sup>	557		330	U	561		330	U	476	
206-44-0	Fluoranthene	82000000 <sup>a</sup>	3,970		899		4,820		381		1,760	
129-00-0	Pyrene	61000000 <sup>a</sup>	2,240		514		2,650		330	U	1,510	
56-55-3	<b>Benzo[a]anthracene</b>	170000 <sup>a</sup>	1,780		407		1,760		330	U	1,180	
218-01-9	<b>Chrysene</b>	17000000 <sup>a</sup>	1,690		419		2,150		330	U	2,030	
205-99-2	<b>Benzo[b]fluoranthene</b>	170000 <sup>a</sup>	2,840		620		2,870		330	U	2,170	
207-08-9	<b>Benzo[k]fluoranthene</b>	1700000 <sup>a</sup>	1,380		330		1,690		330	U	1,320	
50-32-8	<b>Benzo[a]pyrene</b>	17000 <sup>a</sup>	1,770		424		1,850		330	U	1,100	
193-39-5	<b>Indeno[1,2,3-cd]pyrene</b>	170000 <sup>a</sup>	512		330	U	632		330	U	362	
53-70-3	<b>Dibenz[a,h]anthracene</b>	17000 <sup>a</sup>	330	U	330	U	330	U	330	U	330	U
191-24-2	<b>Benzo[g,h,i]perylene</b>		397		330	U	513		330	U	364	
86-74-8	<b>Carbazole</b>	6200000 <sup>a</sup>	330	U	330	U	330	U	330	U	330	U
132-64-9	Dibenzofuran		365		330	U	707		330	U	422	
91-57-6	2-Methylnaphthalene		652		330	U	1,970		330	U	1,160	
95-48-7	o-Cresol	100000000 <sup>a</sup>	330	U	330	U	330	U	330	U	330	U
106-44-5	m&p-Cresol		330	U	330	U	330	U	330	U	330	U
105-67-9	2,4-Dimethylphenol	41000000 <sup>a</sup>	330	U	330	U	330	U	330	U	330	U
108-95-2	Phenol	120000000 <sup>a</sup>	330	U	330	U	330	U	330	U	330	U

Q - qualifier

U - Undetected, Bold Compounds are carcinogenic PAHs

a - Ingestion Pathway

( Near Surface S VOCs Results ( )  
 Parking Lot Expansion  
 Outboard Marine Corporation  
 Waukegan Plant 1

CAS No.	Compound	IEPA TACO	SB-OMC-1A		SB-OMC-1B		SB-OMC-2A		SB-OMC-2B		SB-OMC-3		SB-OMC-4	
		Tier 1/Cons. Worker	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q
71-43-2	Benzene	2100 <sup>a</sup>	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
100-41-4	Ethyl benzene	58000 <sup>a</sup>	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
108-88-3	Toluene	42000 <sup>a</sup>	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
108-38-3	Xylenes (total)	410000 <sup>a</sup>	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U

Q - Qualifier

U - Undetected

a - Inalation Pathway

( Near Surface : VOCs Results (

Parking Lot Expansion  
 Outboard Marine Corporation  
 Waukegan Plant 1

CAS No.	Compound	SB-OMC-4D		SB-OMC-5		SB-OMC-6		SB-OMC-7		SB-OMC-8	
		ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q	ug/kg	Q
71-43-2	Benzene	2.0	U	2.0	U	2.0	U	2.0	U	2.0	U
100-41-4	Ethyl benze	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
108-88-3	Toluene	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U
108-38-3	Xylenes (tot	5.0	U	5.0	U	5.0	U	5.0	U	5.0	U

Q - Qualifier

U - Undetected

a - Inalation Pathway

( Near Surface Metal Results ( )  
 Parking Lot Expansion  
 Outboard Marine Corporation  
 Waukegan Plant 1

CAS No.	Analyte	IEPA TACO	SB-OMC-1A		SB-OMC-1B		SB-OMC-2A		SB-OMC-2B		SB-OMC-3		SB-OMC-4	
		Tier 1/Cons. Worker	mg/kg	C	mg/kg	C	mg/kg	C	mg/kg	C	mg/kg	C	mg/kg	C
7440-38-2	Arsenic	61 <sup>a</sup>	10.2		13.7		3.7		102		3.8		6.2	
7440-43-9	Cadmium	200 <sup>a</sup>	0.5		0.8		0.4		0.7		0.6		4.0	
7439-92-1	Lead	400 <sup>a</sup>	3.0		5.1		6.0		7.3		12.5		38.0	
7439-97-6	Mercury	61 <sup>a</sup>	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
7782-49-2	Selenium	1000 <sup>a</sup>	0.2	U	0.2	U	0.2	U	0.2	U	0.8		0.2	U
57-12-5	Cyanide	4100 <sup>a</sup>	0.1	U	0.1	U	0.42		0.2		0.1	U	0.2	

C - qualifier

U - Undetected

a - Ingestion Pathway

( Near Surface Soil Metal Results )  
 Parking Lot Expansion  
 Outboard Marine Corporation  
 Waukegan Plant 1

CAS No.	Analyte	IEPA TACO	SB-OMC-4D		SB-OMC-5		SB-OMC-6		SB-OMC-7		SB-OMC-8	
		Tier 1/Cons. Worker	mg/kg	C	mg/kg	C	mg/kg	C	mg/kg	C	mg/kg	C
7440-38-2	Arsenic	61 <sup>a</sup>	4.8		1.8		5.4		1.7		4.7	
7440-43-9	Cadmium	200 <sup>a</sup>	1.2		0.5		2.5		0.4		0.6	
7439-92-1	Lead	400 <sup>a</sup>	14.2		3.3		27.9		7.8		22.6	
7439-97-6	Mercury	61 <sup>a</sup>	0.05	U	0.05	U	0.05	U	0.05	U	0.05	U
7782-49-2	Selenium	1000 <sup>a</sup>	0.2	U	0.2	U	0.2	U	0.2	U	0.2	U
57-12-5	Cyanide	4100 <sup>a</sup>	0.1	U	0.1	U	0.1	U	0.3		0.1	U

C - qualifier

U - Undetected

a - Ingestion Pathway